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Plan revision date: August 2023

TESTING AND MONITORING PLAN
40 CFR 146.90

NBU CCS Site

Facility name: NBU CCS Site

- NBU- CCS 1 Arbuckle
- NBU- CCS 2 Arbuckle

Facility contact: Ronald T. Evans, tevans@capturepointllc.com
1101 Central Expy S, Suite 150, Allen, TX 75013
832-300-8225

Well locations: Osage County, Oklahoma

NBU- CCS 1: 36.8292741/ -96.7251231
NBU- CCS 2: 36.8228557/ -96.7251776

This Testing and Monitoring Plan describes how CapturePoint Solutions, LLC will monitor the NBU CCS Site pursuant to 40 CFR 146.90. In addition to demonstrating that the project injection well are operating as planned, the carbon dioxide (CO_2) plume and pressure front are moving as predicted, and that there is no endangerment to USDWs, safety or the environment. All the monitoring data will be used to validate and adjust the geological models used to predict the distribution of the CO_2 within the storage zone to support AoR reevaluations and non-endangerment demonstrations.

Results of the testing and monitoring activities described below may trigger action according to the "*Emergency and Remedial Response Plan*" (Module E).

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1. Overall Strategy and Approach for Testing and Monitoring

This Testing and Monitoring Plan describes the strategy of how CapturePoint Solutions, LLC will conduct tests and monitor the injection site with the goal of having sufficient data to ascertain the following primary objectives.

a) To collect sufficient data to adequately evaluate site-specific system behavior.
b) Test and monitor the targeted storage zone (Arbuckle) within the defined AoR.
c) Demonstrate there is no endangerment to USDWs safety or the environment.
d) The CO_2 plumes and pressure fronts are behaving as predicted within the defined AoR.
e) The injection wells are operating as planned and within permitted limits.
f) CO_2 injection streams are as per the permit application.

A regular assessment and adaptation of the plan will be conducted to ensure that it remains appropriate for the site and is adequately tracking the injected CO_2, thereby providing a detailed assessment of the site performance in containing the sequestered CO_2. The storage capacity of the site has been evaluated with expected injection volumes. In accordance with 40 CFR 146.90 (j) this testing and monitoring plan will be re-evaluated every 5 years (at a minimum) or more frequently at the direction of the underground injection control (UIC) Director. The review process will evaluate whether the current plan will require an amendment (or no amendment). Any observed deviation from permitted operational conditions could trigger a more frequent review. All amendments will be approved by the UIC Director and incorporated into the currently authorized operating permit.

Results from the *Testing and Monitoring Plan* will be submitted on a semi-annual basis (every six months from the start of injection). Semi-annual reports will contain information describing the composition of the injectant, monthly injection operations, results from continuous monitoring devices, fluid and materials analysis and description of any events caused by an exceedance or triggered shut-off. Details of the reporting frequencies are listed in **Table 1**. Results will be provided through the GSDT on a semi-annual basis per 40 CFR 146.91(a) or applicable state requirements.

Monitoring of groundwater quality above the confining zone will occur in the Mississippi Formation (first permeable layer above the confining zone and in the overlying Oscar and Vanoss formations. The Mississippi Formation is a saline buffer aquifer below the lowermost zone of freshwater. The Oscar and Vanoss formations are freshwater zones with poor deliverability but will be monitored as if they were USDWs. This Testing and Monitoring Plan is site-specific and intended to monitor injection operations and the pressure front and CO_2 plume. The measured depths of the target storage zone are between 3,455 and 4,320 feet deep. The targeted storage interval for this project occurs roughly 3,155 feet below the deepest USDW and includes the Arbuckle Formation.

The project sponsor CapturePoint Solutions along with its parent has collective experience from 30 years of operating more than 15 CO_2 tertiary enhanced oil recovery floods. CPS has drawn on this experience in coming up with the required testing and monitoring parameters and these are in line with the current industry standards and practices.

Table 1. Testing and monitoring reporting items.

Parameters Monitored	Monitoring Program	Target Structure/ Project area	Monitoring & Reporting Frequency
I. CO_2 stream Analysis			
1. Chemical Composition of CO_2 Stream	**T1.** Compositional analysis of the injected CO_2 stream using non-destructive Chromatographic detector	Injection metering point in the Inlet Meter	Quarterly or as additional sources are included in the injection stream
II. Continuous Recording of Operational Parameters			
2. Physical Characteristics of CO_2 Stream	**T2.** (**T2.a**) Pressure and (**T2.b**) temperature gauge, flow meter with alarms for measurements outside of the normal operating conditions	Injection metering point	Continuous monitoring. Summary Monthly statistics prepared and reported quarterly.
3. Well Annulus Fluid	• **T3**. Annuler pressure gauge	Between tubing and production casing annulus at Wellhead	
	T4. Annular Fluid volume measurements	Record if additional volume is required to fill Annulus and maintain positive pressure on the annulus.	
III. Corrosion monitoring			
4. Coupon Test	**T5**. Flow-through corrosion coupon using injection well construction materials **T6**. Utilize Corrosion inhibitors in all fluids during well workovers	Injection metering point just prior to the Wellhead.	Quarterly analysis during injection operations
IV. **Above confining zone monitoring**			

Parameters Monitored	**Monitoring Program**	**Target Structure/ Project area**	**Monitoring & Reporting Frequency**
5. Monitoring Well	**T7**. Temperature, pressure, and fluid analysis	Monitoring well located in the center of injection wells Multiple monitoring wells monitoring the first permeable layer above the confining zone	Monthly fluid sampling during the first year of operations to determine baseline and then annual for 3 years shifting to once every 2 years in case of no deviation (Continuous pressure and temperature monitoring) during injection. Post injection samples every 5 years.
6. Near Surface Monitoring	**T8**. Fresh water analysis Vanoss/Hoover (lowermost USDW) **T9**. CO_2 leak detection equipment with auto warning systems	AoR	Monthly sampling during the first year of operations to determine baseline and then annual for 3 years shifting to once every 2 years in case of no deviation during injection. Post injection samples every 5 years.
		At Wellhead and key wellsite locations (e.g. Flowline riser)	Event summaries in quarterly reports Inspection and testing semi-annually.
V. Mechanical integrity testing (MIT)			
8. Internal Tests	**T11**. Tubing – casing annulus pressure testing	At the Wellhead	8a. Annulus Pressure Test – annually Temperature Log – annually
	T12. Ultrasonic, CCL (casing collar locator), VDL (variable-density-log), GR and Temperature log	To be done if the Pressure testing in 8a above suggests deviations that needs further investigation.	
9. External Tests	**T13**. Casing Integrity Tools – Ultrasonic imager tool (USIT) or EM casing inspection tool	To be done if the pressure testing in 8a above suggests deviations that need further investigation	Annually

Parameters Monitored	Monitoring Program	Target Structure/ Project area	Monitoring & Reporting Frequency
VI. **Pressure fall-off testing**			
10. Pressure Fall-off Tests		All injection wells	First test at completion of well(s), thereafter, once every 5 years during injection operations
VII. **CO_2 plume and pressure front tracking**			
11. Direct Reservoir Monitoring	**T.14**. Wireline based downhole pressure and temperature gauges, injection profile surveys and saturation logs	In-zone monitoring and injection wells	Quarterly. Baseline taken during completion of in-zone monitoring wells and all injection wells. Annual measurements until plume stabilization post injection.
	T.15. Pulsed Neutron- Log (PNL) or Oxygen Activation Log to ensure fluids are contained with the storage interval	Observation Well for Storage reservoir monitoring and injection wells Monitoring Well for Primary sealing formation monitoring	Baseline at completion, every 2 years during injection operations, every 5 years post injection for 10 years
12. Indirect Reservoir Monitoring	**T.16**. Gravity surveys	AoR	Baseline, one during operations after adequate mass change, one post injection
	T.17. Monitor Pressure to detect the progression of pressure front	Monitoring well	Quarterly measurements, quarterly summary reporting

The proposed location for this GS project is ideally suited as there is no faulting or breaches that impact the injection intervals or the primary confining layer (**Figure 1**). The area is seismically stable and has no history of significant ground motion. Additional information regarding site characterization is described in the "*Project Information Tracking*", submitted in Module A. Additionally, the proposed injection operations per this permit will occur below the estimated fracture gradient and within a 90 percent fracture gradient safety margin as not to cause any fracturing or potentially induce seismicity.

Prior to injection operations, a baseline analysis of shallow and deep groundwater will be collected and established, along with the measurement of the injection zone pressures and temperatures. Future analysis and measurements collected during injection operations, will be regularly compared to baseline results in order to identify significant deviations which may require a review of the "*AoR and Corrective Action Plan"* and execution of protocols within the Emergency and Remedial Response Plan.

A general plan for collection process, analysis procedure and calculations are given in the associated "*Quality Assurance and Surveillance Plan*" (QASP). Specific labs or vendors will be updated in future plan revisions, as these are finalized during project implementation. The general strategy to deal with any deviations in observations from the baseline parameters is also shared.

Monitoring of the injection interval will occur via an in-zone monitoring well located up-dip of the injection site and on the

Preliminary estimates of the CO_2 plume size were determined using Equation 1 and are based on the volume of injectate, its viscosity, water saturation, formation volume factor and matrix porosity:

$$\text{Equation 1} \rightarrow R_{plume} = \sqrt{\frac{V_i \cdot B_g}{(1-S_w) \cdot \emptyset \cdot \pi \cdot H}}$$

Pressure front radius estimates (a measure of transient pressure) resulting from injection were determined using Equation 2 and are based on time and matrix properties such as pore compressibility, porosity and permeability:

$$\text{Equation 2} \rightarrow R_{pf} = \frac{kt}{\emptyset(uc_{t)} r_w^2}$$

Pressure differential estimates for AoR evaluation were developed using Equation 3.

$$\text{Equation 3} \rightarrow P = P_u + \rho_i g(Z_u - Z_i)$$

Computational modeling as described in the "*AoR and Corrective Action Plan*" (Module B) for this permit application has predicted that the CO_2 plume sizes are estimated to ultimately have a maximum radius of between 1.5 and 2 miles and the expected maximum pressure front radius is roughly 2.5 miles from the location of any injection well. It is anticipated that the CO_2 plume will be somewhat oblate in shape due to potential up-dip migration of the injectant and therefore the placement of the injection zone monitoring wells have been placed accordingly. Timestep maps of the developing plume are shown in **figures 2 through 7**. It is important to note that computer simulation did not account for CO_2 trapping mechanisms and therefore the results represent an ultimate maximum of the plume's subaerial extent.

Figure 8 provides well location and well information for the NBU CCS Site. The in-zone monitoring well will be drilled and completed up-dip and east of the injection site. The monitoring wells will be located within approximately one mile of the injection wells. The monitoring of the Mississippi Formation, the first saline sand package above the primary confining zone, will be monitored from a well located at the injection site between the two injection pads. Sampling and monitoring of USDWs within the AoR will occur near the center of the injection site and adjacent to the in-zone observation and monitoring well. Water supply wells will be installed at these locations to support drilling operations. These wells will then be converted to USDW monitoring wells from which fluid samples will be collected for analysis. Sample collection and analysis will occur quarterly (every three months) from the start of injection operations. The purpose of this aspect of the Testing and Monitoring Plan is to demonstrate that migration of formation brines and injected CO_2 is not occurring above the primary confining zone and to verify that there is no endangerment to USDWs within the AoR.

Figure 1. General Location Map of Project Site

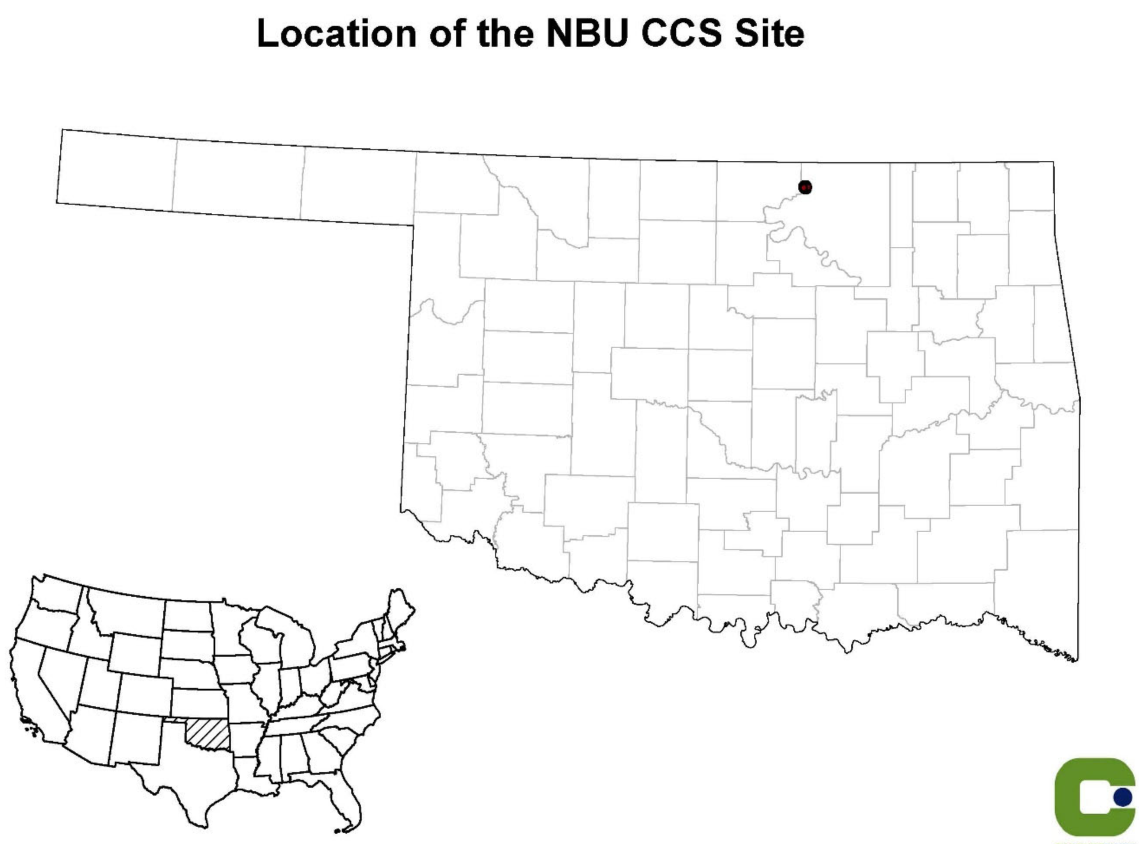


Figure 2. Plume after 5 years of injection

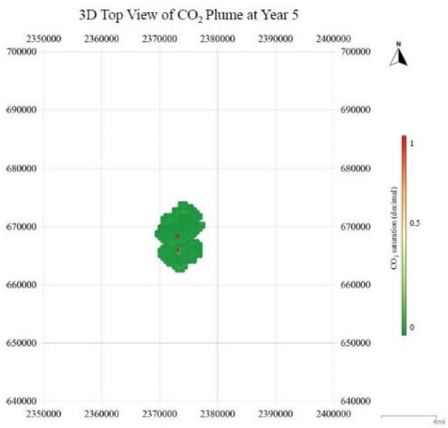


Figure 3. Plume after 10 years of injection

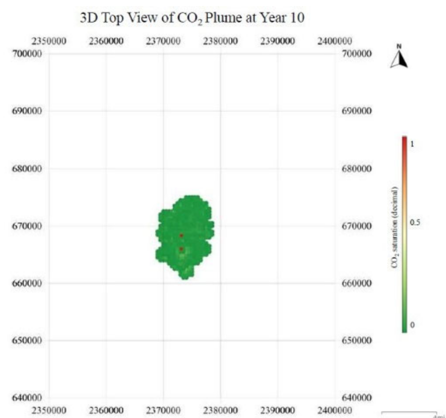


Figure 4. Plume after 15 years of injection

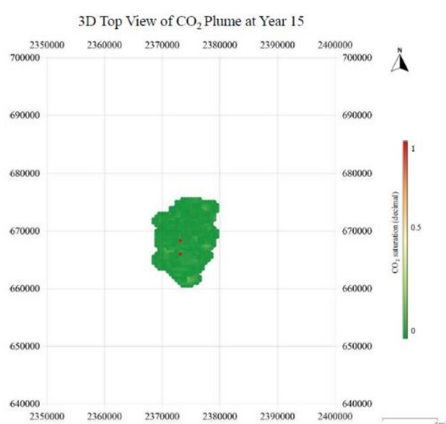


Figure 5. Plume after 20 years of injection

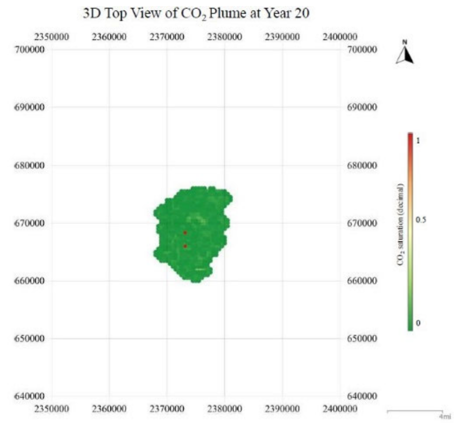


Figure 6. Plume 5 years post-injection

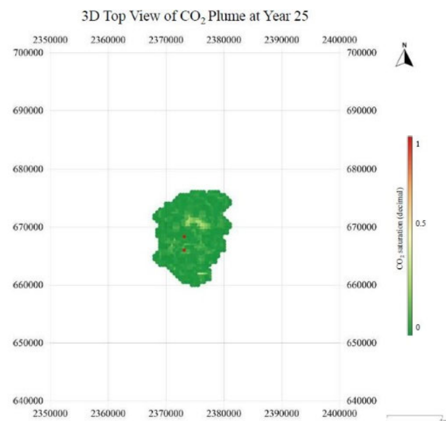


Figure 7. Plume 30 years post-injection

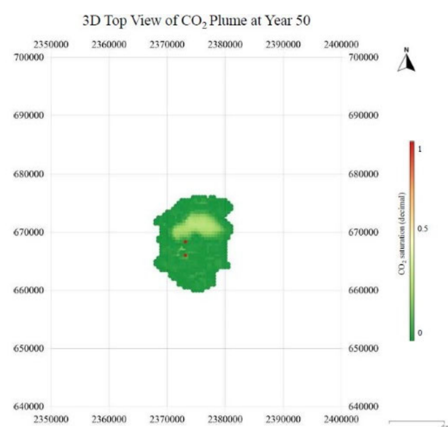
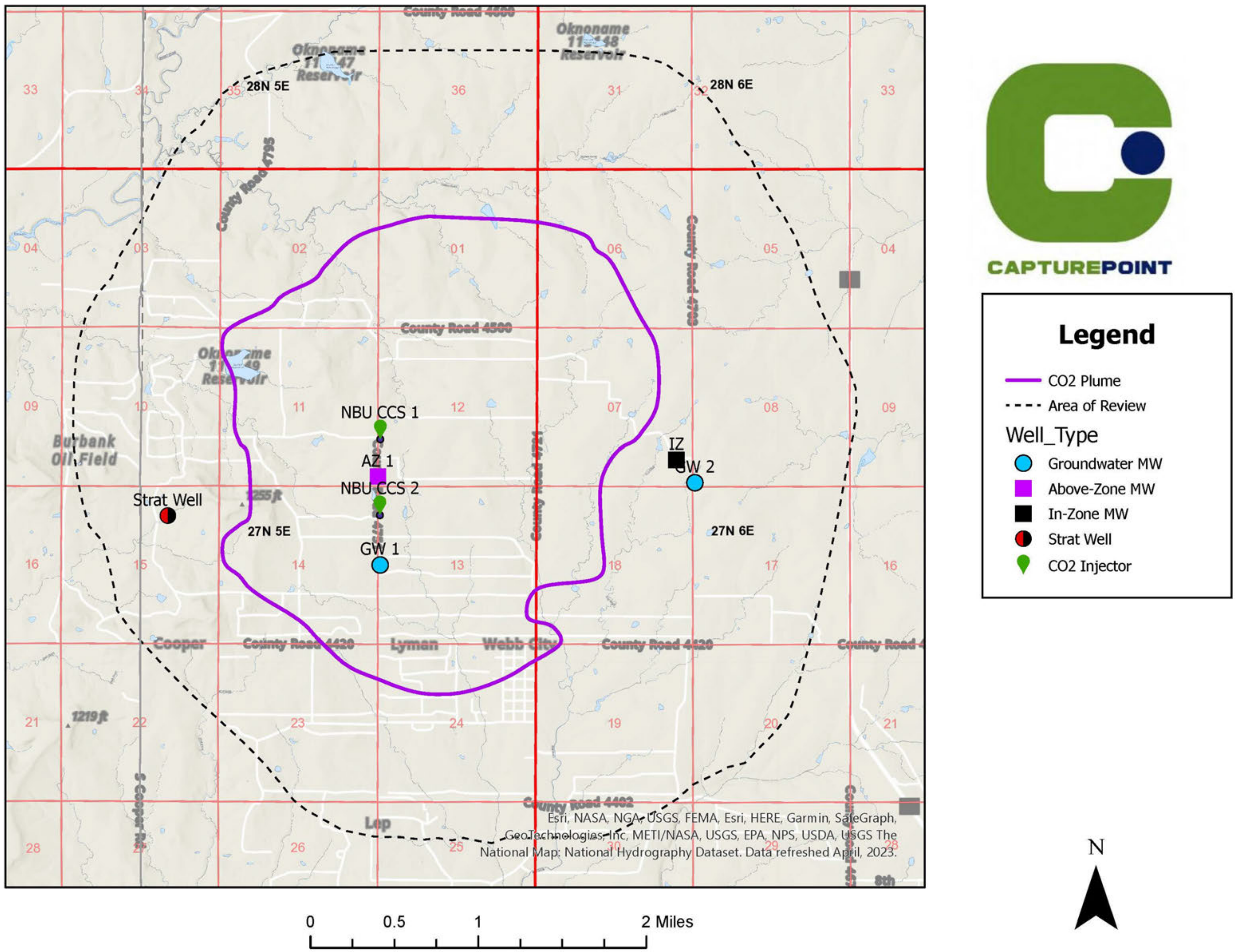


Figure 8. Map of AoR, CO_2 Plume and Well Locations



Site-specific considerations used to determine monitoring and testing methods is based on several factors 1) the geologic structure and dip angle of the formation receiving the injectant 2) thickness of the injection intervals and 3) estimated lateral extent of the porosity and permeability of the injection zone. Data collection frequencies are based on required permit application criteria and from established and documented subsurface fluid flow observed in conventional oil and gas operations.

The overall testing and monitoring strategy for this site is based on local and regional characterization of the subsurface geology including 1) geological structural history 2) local stratigraphy 3) lateral facies and lithology changes 4) measured geophysical properties from well logs and seismic 5) depth, thickness, and distribution of underground sources of drinking water (USDWs) and 6) depth and thickness of the confining and injection zones. This strategy will also take into account the potential for induced seismicity and the number of potential conduits that could result in vertical migration of the injected CO_2.

To reduce the limited risk of a plugged and abandoned well that penetrated the primary confining zone or the injection zone, all of the wells that meet these criteria will be evaluated and mitigated as determined by the following criteria 1) age and period of drilling 2) depth and completion history and 3) plugging and abandonment methods. Legacy well locations are addressed in the "*AoR and Corrective Action Plan*" Module B.

1.1 Quality assurance procedures

A "*Quality Assurance and Surveillance Plan*" (QASP) for all testing and monitoring activities, required pursuant to 40 CFR146.90(k), is provided as an attachment to this Testing and Monitoring Plan as the "*Quality Assurance and Surveillance Plan*".

1.2 Reporting procedures

CapturePoint Solutions, LLC will report the results of all testing and monitoring activities to the USEPA in compliance with the requirements under 40 CFR 146.91. Collected information during the Testing and Monitoring period for each component of the plan will be submitted per the required reporting schedule as outlined in the UIC Class VI Testing and Monitoring Guidance document under 816-R-13-005. Reporting of the required information will be performed electronically through the Geologic Sequestration Data Tool (GSDT) in semi-annual (every six months) reports per 40 CFR 146.91(a).

2 Carbon Dioxide Stream Analysis

CapturePoint Solutions, LLC will analyze the CO_2 stream before and during the operation period to yield data representative of its chemical and physical characteristics and to meet the requirements of 40 CFR 146.90(a). Sampling and analysis procedures are described in the attached QASP.

2.1 Sampling location and frequency

CapturePoint Solutions, LLC will analyze the CO_2 sources prior into inclusion into the injection stream prior to injection and then quarterly throughout the operational period. Sampling will occur upstream of the flow meter located at the wellhead, prior to injection. The analysis will provide information about the chemical and physical characteristics of the injectant.

The frequency of CO_2 sampling will be conducted on a quarterly basis commencing with the initiation of injection operations. This equates to a schedule as follows:

1. Sample No. 1 – 3 months after the start of injection
2. Sample No. 2 – 6 months after the start of injection
3. Sample No. 3 – 9 months after the start of injection
4. Sample No. 4 – 12 months after the start of injection

This schedule will then repeat using the quarterly sampling cycle.

If there are changes to the CO_2 emission process upstream, an additional stream analysis will be done after each such change. If changes in the chemical and physical characteristics of the CO_2 stream occur, a change in the sampling schedule will be triggered. If additional sources of CO_2 are incorporated into the injection stream, those sources will be analyzed prior to injection.

2.2 Analytical parameters

CapturePoint Solutions, LLC will analyze the CO_2 for the constituents identified in **Table 2.** Analytical methods are detailed in the attached QASP which will follow either ISBT or ASTM regulatory accepted tests.

Table 2. Summary of analytical parameters for CO_2 stream.

Parameter	Analytical Method(s)
Water	ISBT and or ASTM will be required, details are described in the attached QASP
Oxygen	
Nitrogen	
Carbon Monoxide	
Oxides of Nitrogen	
Sulfur Dioxide	
Total Hydrocarbon	
Hydrocarbons	
Acetaldehyde	
Hydrogen Sulfide	
Carbon Dioxide	
Isotopic ^{13}C and ^{14}C ratio	

All CO_2 that is delivered to the site will meet the following specifications in **Table 3** below. Listed CO_2 specifications meet minimum pipeline criteria. Any CO_2 not meeting the CO_2 quality specification will be rejected if it is determined that damage to the CO_2 pipeline or it significantly increases the risk of safety or environmental impacts.

Table 3. CO_2 specifications at Capture Sites

Parameter	Limit
Pressure	2,200 psi at transfer point
CO_2:	96.0 mole % minimum;
Methane (C1)	< 3.0%
Ethane plus (C2+)	< 1.0%
Hydrogen Sulfide (H_2S)	< 20 ppm by weight
Total Inerts and Nitrogen:	< 4.0 mole % maximum;
Water (H_2O):	< 30 lbs. per MMSCF;
Temperature:	100°F maximum.
Hydrocarbons	< 76 ppm by vol.;
Sulfur	< 35 ppm by weight
Oxygen	< 10.0 ppm by weight.;
Carbon Monoxide	< 20 ppm vol.

2.3 Sampling methods

All sources of CO_2 will be collected and analyzed prior to injection. Sample collection procedures, chain of custody, and detection limits of constituents are included in the attached QASP.

Samples will be analyzed by a third party laboratory accredited by the Louisiana Department of Environmental Quality (https://internet.deq.louisiana.gov/portal/divisions/lelap/accredited-laboratories) using standardized procedures for gas chromatography, mass spectrometry, detector tubes and photo ionization. Detection limits will be dependent on equipment facilitated for the analytical methods by the selected vendor.

2.4 Laboratory to be used/chain of custody and analysis procedures

Certified third-party laboratories will be selected prior to drilling the stratigraphic test well. Details and information regarding the selected labs will be provided as an update to the QSAP and UIC Program Director. Chain of custody and analysis procedures are detailed in sections B.3 and B.4 in the QSAP.

3 Continuous Recording of Operational Parameters

CapturePoint Solutions, LLC will install and use continuous recording devices to monitor injection temperature, pressure, rate; the pressure on the annulus between the tubing and the long string casing; the annulus fluid volume added, as required at 40 CFR 146.88(c)(1), 146.89(b), and 146.90(b).

Injection rate will be limited to a maximum of ~1,644 (19.2 tonnes per mcf) metric tons per day as follows:

- Arbuckle Formation rate = 28.7 mmcf/day

Injection pressures will be limited to less than 90 percent of the fracture gradient within the injection zone. Estimated fracture gradient and pressure for the injection zone (Arbuckle) are discussed in the "*AoR and Corrective Action Plan*" (Module B). All aspects of the injection processes will be monitored, recorded, and if necessary, shut down in the event of a detected exceedance. Surface pressure and temperature will be measured continuously; to determine the density of the injected CO_2 and then be used to determine the volume of the CO_2 injected. The volume will be determined from a flow meter installed on the injection supply line.

3.1 Monitoring location and frequency

CapturePoint Solutions, LLC will perform the activities identified in **Table 4** to monitor operational parameters and verify internal mechanical integrity of the injection well. All monitoring will take place at the locations and frequencies shown in the table.

Injection rate, pressure and temperature reporting will occur semi-annually and include the following for each of the six months in the reporting period.

a) Monthly average flow rate.
b) Monthly maximum and minimum values.
c) Total volume (mass) injected each month.
d) Cumulative volume (mass) for the project.

An explanation of event(s) for any measurable deviation from pervious reporting periods or plan.

Table 4. Sampling devices, locations, and frequencies for continuous monitoring.

Parameter	Device(s)	Location	Min. Sampling Frequency	Min. Recording Frequency
Annular Pressure Monitoring	Capacitance Gauge	Surface/wellhead	1 minute	30 minutes
Injection Pressure Monitoring (Surface)	Capacitance Gauge			
Injection Pressure Monitoring (Downhole)	Calculated from surface pressure and density of CO_2	Reservoir		
Injection Rate Monitoring	Flow Computer	Surface/wellhead		
Injection Volume Monitoring	Data from flow computer and density of the CO_2 will determine the volume			
Temperature Monitoring	Flow computer will have a continuous temperature reading		Every 10 seconds	

Parameter	Device(s)	Location	Min. Sampling Frequency	Min. Recording Frequency
Annular fluid level		Surface/wellhead/fluid tank levels		

Calibration standards, precision, formulas, conversion factors, and tolerances for measuring devices and analysis are included in the attached QASP.

In the event there is a noticeable pressure or temperature fluctuation within the well bore this will trigger a signal and possibly a shut-off device. Data collected prior to the detected deviation will be analyzed and a triggered Testing and Monitoring Plan will be employed to determine the cause.

Phased increases in anticipated injection volumes and or additional sources of CO_2 that are incorporated into the injection stream will require a revision to the testing and monitoring frequency.

3.2 Monitoring Detail

Injection rates, volumes and pressure will be set and limited by the authorized permit. Alarms will be set to alert operators to high flow rates, low annulus pressure and low level in the annulus fluid tanks. The flow meters and pressure gauges at the surface will provide electronic readings to a computer with an applicable backup system.

Automatic alarm and shutoff systems will be designed and installed to sound in the event that pressures, flow rates or other parameters designated by the UIC Program Director exceed a range or gradient specified in the injection permit per 40 CFR 146.88(e)(2). If an alarm or shutdown is triggered, CapturePoint Solutions, LLC will immediately investigate and identify the cause of the alarm or shutoff (See the "*Emergency and Remedial Response Plan*" (Module E) [40 CFR 146.94(a)] for details).

The purpose of the annulus pressure system is to maintain a positive pressure of at least 100 psi in excess of the tubing pressure and to prevent contamination of USDWs in the event of well casing or injection tubing failure. Integrity of the well's annulus system is achieved by controlling and maintaining the well annulus pressure at least 100 psig higher than the injection tubing pressure. The annulus pressure system will be located at the wellhead and annulus monitoring equipment such as tanks, pumps and flow meters will also be located on the well pad.

In-zone reservoir temperature and pressure of the targeted injection zone will be accomplished using bottomhole and surface gauges and sensors in the in-zone monitoring well.

4 Corrosion Monitoring

To meet the requirements of 40 CFR 146.90(c), CapturePoint Solutions, LLC will monitor supply lines, well components, and monitoring equipment during the operational period for loss of mass, thickness, cracking, pitting, and other signs of corrosion to ensure that the well components meet the minimum standards for material strength and performance. This plan is meant to ensure that the injection operations are performing as permitted and that there is no endangerment to safety, the environment or USDWs.

Corrosion monitoring will be performed using a flow-through corrosion test loop to monitor internal corrosion potential and scheduled inspections of surface equipment to monitor external corrosion, cracking and or mechanical damage. Sample coupons will be directly exposed to the injection stream during operations within a secondary line that can be shut off and isolated from the main injection line so that samples can be removed and replaced during operations. Sample coupons from the flow-through device will be evaluated quarterly (beginning three months after the start of injection) Sample evaluations will be included in the semi-annual report. The flow-through test system and scheduled inspections will be used in conjunction with MITs to monitor and detect potential issues during the injection phase of the project. Analysis of sampled materials will be conducted by a certified third-party laboratory.

The plan is intended to serve three purposes 1) corrosion and monitoring prevention 2) surface leak detection and 3) subsurface leak monitoring and prevention. If deviations from expected operations are detected, results from the corrosion monitoring data will be used to assess, develop and implement an appropriate mitigation strategy as well as adjust the corrosion testing and monitoring frequency.

Surface leak detection will be achieved using continuous monitoring well head detectors and by visual inspection. Visual inspection of surface equipment will occur on a daily basis and or in the event of a detected surface leak.

Subsurface leak detection as a result of corrosion will be conducted using three methods 1) sample coupon exposure to the injection stream at a test station between the last stage of compression and the wellhead 2) pressure and temperature monitoring devices located at the wellhead and 3) scheduled mechanical integrity tests (MITs).

The coupon method involves exposing a specimen sample of material (the coupon) to a process environment for a given duration, then removing the specimen for analysis. The Corrosion Monitoring Plan will be implemented following initial installation of the test coupons in the flowline, as follows:

- Consult maintenance schedule to determine when to remove test coupons from corrosion monitoring holders (coincident with end of calendar quarter);
- Remove and inspect coupons on a calendar quarterly basis and quantitatively evaluate for corrosion according to ASTM G1 – 03 (2017) or NACE Standard RP0775-2005 Item No. 21017 standards guidelines;
- Place coupons in proper receptacle for safe transport to measurement and weighing equipment;
- Photograph each coupon as received. Visually inspect each corrosion coupon for any pitting, stress corrosion cracking or scale buildup. Analyze corrosion coupons by weighing each coupon (to nearest 0.0001 gm) and measuring length, width and height of the coupon (to nearest 0.0001 inch);
- Record information for each coupon including date of measurement, coupon identity (coupon number and metal grade) and coupon weight in grams, and include any observations of excessive weight loss or pitting, stress corrosion cracking or scale buildup;
- Determine if current corrosion coupon can be returned to the monitoring test holder, make a note of coupon return, or if not make a note of installation of a new coupon.

4.1 Sample description

Materials that will be monitored and tested for corrosion are listed in **Table 5.** The samples will be evaluated for signs of loss of mass, thickness, cracking, pitting, and other indications of corrosion. Sample coupons of the various materials will be prepared and assessed prior to exposure to the injection stream to establish baseline conditions. The coupons will be dated, photographed and described to indicate their condition prior to testing.

Table 5. List of equipment coupon with material of construction.

Equipment Coupon	Material of Construction
Pipeline	Carbon Steel or "as built CO_2 resistive materials"
Long String Casing	Carbon Steel or "as built CO_2 resistive materials"
Injection Tubing	Internally coated carbon steel
Wellhead	Carbon Steel with stainless steel trim
Packers	Carbon Steel with stainless steel trim
Packer Elements	Viton material

4.2 Monitoring details

Testing will occur at the surface between the final stage of compression and the wellhead. Material corrosion testing and monitoring will be conducted by employing a flow through pipe with material coupon holders that are directly exposed to the injection stream prior to entering the wellhead. During the first year of injection material testing coupons will be pulled and examined each quarter (every three months). The coupons will be described, photographed and sent to a certified third-party laboratory for further analysis. Details regarding the laboratory analysis are explained in the attached QASP.

Samples will be collected by trained and authorized personnel and submitted to a third-party certified laboratory for analysis. Results of the analysis will be compared to the pre-exposure baseline condition of the material coupons.

The frequency of corrosion coupon collection and testing will be conducted on a quarterly basis per 40 CFR 146.90(c) commencing with the initiation of injection operations. This equates to a schedule as follows:

1. Sample No. 1 – 3 months after the start of injection
2. Sample No. 2 – 6 months after the start of injection
3. Sample No. 3 – 9 months after the start of injection
4. Sample No. 4 – 12 months after the start of injection

The schedule will then repeat using this quarterly sample cycle for the duration of injection operations.

Additionally, per 40 CFR 146.90, CapturePoint Solutions, LLC may run a casing inspection log (CIL) to determine the presence or absence of corrosion in the long string casing when the tubing is pulled from the well, or at the request of the UIC Program Director. The log(s) will be compared to those run during the initial construction of the well (40 CFR 146.87). Additional inspection logging may be performed should the coupons show excessive corrosion in excess of the design-life criteria.

5 Above Confining Zone Monitoring

CapturePoint Solutions, LLC will monitor the first permeable zone above the confining zone (Upper Mississippi) as well as groundwater quality in the shallow freshwater zones (Oscar and Vanoss) for geochemical changes during the operational and post-injection periods to meet the requirements of 40 CFR 146.90(d). Results from sampling and analysis will be compared to baseline values determined pursuant to 40 CFR 146.82(a)(6). The Upper Mississippi saline aquifer will be monitored in an above zone well to be located between the injection wells. The Oscar and Vanoss freshwater zones will be monitored at two locations, one monitoring well is located south of the injection wells and the second will be located to the east near the offset in-zone monitoring well.

The first approach will be to monitor the first permeable layer overlying the confining zone. This will provide a "first" point detection of a potential leak out of the injection zone. A monitoring well will be installed within the formation with gas detection devices at the surface. Monitoring parameters and baseline programs are identified in **Table 6**. Baseline parameters for initial fluid properties will be collected during the drilling and completion of the well, see the "*Pre-Operation Testing and Logging Plan*" (Module D).

The second approach will be to monitor groundwater quality, geochemical changes and pressure changes in the USDW above the confining zones, which is focused on the locally used aquifers (see Local Resources and Infrastructure **Table 1** in the "*Emergency and Remedial Response Plan*" (Module E). There are no USDWs below the injection zone at the project site and CapturePoint Solutions, LLC is not requesting an injection depth waiver.

Table 6. Monitoring parameters and baseline programs.

<table>
<tr><th>Monitoring Parameter</th><th colspan="2">Baseline Data program</th><th>Baseline</th><th>Operational</th><th>Post-Operational</th></tr>
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Monitoring Parameter	Baseline Data program	Baseline	Operational	Post-Operational
Injection Zone Pressure	Injectivity tests, and pressure fall-off testing			None

Prior to injection, baseline data from the confining layer, injection zone, and the permeable saline zone immediately above the confining zone, will be collected during the drilling, coring, and logging of a stratigraphic test well. Groundwater samples from known freshwater zones and or USDWs will also be collected and analyzed to establish baseline conditions prior to operations. This information will be compared to observed and analytically determined information to detect changes from baseline conditions throughout the injection phase of the project. If a geochemical and or physical change is observed this will indicate a deviation from the planned and predicted behavior of the injection operations and will cause a cessation of injection operations and trigger the "*Emergency and Remedial Response Plan*" (Module E), which is designed to identify the cause and help to provide information necessary to remediate the deviation. The magnitude of the deviation may require an updated computational model and revision of the AoR, plume and pressure front. Predictions from the updated model can then be evaluated and used for project decision making regarding 1) testing and monitoring methods and protocols 2) injection rates and volumes and 3) determine if additional monitoring data is required to demonstrate Class VI Rule compliance/USDW non-endangerment.

5.1 Monitoring location and frequency

Table 7 shows the planned monitoring methods, locations, and frequencies for ground water quality and geochemical monitoring above the confining zone.

The frequency of ground water quality and geochemical monitoring will be conducted on a quarterly basis per 40 CFR 146.90(d) commencing with the initiation of injection operations. This equates to a schedule as follows:

1. Sample No. 1 – 3 months after the start of injection
2. Sample No. 2 – 6 months after the start of injection
3. Sample No. 3 – 9 months after the start of injection
4. Sample No. 4 – 12 months after the start of injection

Annual sampling will occur up to 45 days before the anniversary date of authorization of injection each year.

Table 7. Groundwater quality monitoring activities.

Phase	Evaluation Target	Description	Sampling and Monitoring Frequency
Pre-injection	USDW water quality	Sampling and analysis are described in the attached QASP.	Baseline
	Water quality in the first permeable layer above the confining zone and from identified USDWs within the AoR		
	Injection zone temperature, pressure and injectivity		
During Injection	Ground water quality First permeable formation above the confining zone pressure, temperature, and water quality USDW water quality	Sampling will occur at the monitoring well locations.	Semi-Annually Quarterly
Post-injection	Groundwater quality and pressure, temperature and water quality in the first permeable formation above the confining zone USDW water quality	Sampling will occur at the monitoring well locations.	Every 10 years Every 5 years

Sampling of the freshwater zones will occur at depths between 100 and 250 feet and sampling of the Upper Mississippi Formation will occur at depths between 3,050 and 3,200 feet.

Deviation tolerances indicating actions worthy of implementing correction action procedures are described in the attached QASP. If deviations of sufficient concern are detected operational shut-off procedures will be triggered. Minor deviations in collected monitoring data will be assessed, accounted for and included in the semi-annual report.

Continuous monitoring of pressure and temperature at the 1) injection well 2) within the injection zone and 3) above the confining zone are listed in order of detection (Figure 2). The spatial locations and depths of the monitoring well required for direct monitoring of water quality based upon the site-specific operational modeling. The modeling well network will be revised and updated as the model updates and adjusts with site-specific details.

Fluid samples from within the injection zone and from the permeable formation directly above the confining layer (Upper Mississippi Formation) (**Table 8**) will be collected and analyzed. Analysis procedures and parameters are described in the attached QASP. Geochemical changes that indicate leakage include increases in levels of TDS, alkalinity, sodium, chloride, sulfate and decreased pH. If these deviations are detected. The appropriate corrective action measures will be implemented (see section E.7.e in the "*Emergency and Remedial Response Plan*" (Module E)).

5.2 Monitoring of groundwater quality and geochemical changes.

CapturePoint Solutions, LLC will monitor groundwater quality and geochemical changes in fluids above the confining zone using a defined monitoring and sampling program utilizing monitoring two wells completed within shallow freshwater zones and one completed deeper in a saline aquifer. One groundwater well is to be completed in the Mississippi Formation (saline aquifer) within the first permeable layer above the primary confining unit. This well will be located within the center of the injection site as this is the most likely location for formation fluid and or CO_2 detection above the confining zone as the result of injection. Two groundwater quality monitoring wells are to be constructed to monitor water quality in the Oscar and Vanoss freshwater zones. One well is to be located within the approximate center of the injection site as to evaluate USDW groundwater quality within the AoR at the expected location of the highest potential for formation fluid and CO_2 leakage out of the injection zone and above the primary confining zone. The other well is to be located east of the injection site near the in-zone monitoring well in order to detect any changes in water quality as a result of vertical and up-dip migration of formation fluids and CO_2 sourced from the targeted injection zone.

Analytical parameters for fluid sampling and analysis for the project will include assessment of cations, anions, dissolved CO_2, isotopes, total dissolved solids, fluid density, alkalinity, pH, specific conductance, and temperature as shown in **Table 9**. Samples will be collected from the designated monitoring wells. Collected samples will be sealed and dated and sent to an authorized third-party laboratory for analysis. Sampling and analysis will occur on a semi-annual basis throughout the duration of the project.

Table 8. Groundwater monitoring targets and activity.

Target Formation	Monitoring Activity	Monitoring Location(s)	Spatial Coverage	Frequency
**Note – Multiple monitoring wells are currently in-place wherein these freshwater zones are currently monitored.				
Oscar & Vanoss	Fluid Sampling and Analysis	Injection site and 1 mile east of the injection site	AoR	Quarterly for first year, annually during injection period and every 10 years post injection

5.3 Analytical parameters

If there is leakage, the presence of CO_2 maybe detected by increases in TDS, alkalinity, sodium, chloride, and sulfate. **Table 9** identifies the parameters to be monitored. Specifications and tolerances are described in section B.4 of the attached QASP.

Table 9. Summary of analytical and field parameters for ground water samples.

Parameters	Analytical Methods
Oscar and Vanoss	
TDS	Analytical methods for ground water analysis are described in the attached QASP.
pH	
Specific Conductance	

Parameters	Analytical Methods
Alkalinity	
Sodium	
Chloride	
Sulfate	

5.4 Sampling methods

Sampling methods and procedures are described in section B.2 of the QASP.

5.5 Laboratory to be used/chain of custody procedures

Analysis will be conducted by a certified third-party laboratory vendor that will be selected at a later date. The selected laboratory will be a state accredited facility. Chain of custody, analytical methods, and detection limits are described in section B.3 of the QASP, with specifics supplied by the selected vendor.

6 External Mechanical Integrity Testing

CapturePoint Solutions, LLC will conduct at least one of the tests presented in **Table 10** periodically during the injection phase to verify external mechanical integrity as required at 146.89(c) and 146.90.

A demonstration of mechanical integrity will made at least once per year during injection operations for all wells penetrating the primary confining layer.

6.1 Testing location and frequency

The integrity of the long string casing, injection tubing and annular seal shall be tested by means of an approved pressure test (see "*Pre-Operational Testing Plan*" submitted in Module D) The integrity of the bottomhole cement shall be tested by means of an approved radioactive tracer survey. A temperature log, or other approved log, will be run annually or following a work over to test for fluid movement along the wellbore.

Table 10. MITs.

Test Description	Location	Frequency
Annulus Pressure Test (APT)	Injection string and casing annulus	Annually
Temperature Survey	Injection and monitoring well(s)	
Radioactive Tracer Survey		

MITs will be run after the initial construction of the well prior to injection operations. During injection operations the MITs will be performed on an annual basis within 45 days of the anniversary of the preceding year's test. CapturePoint Solutions, LLC will notify the UIC Program Director ahead of the testing. This schedule will repeat for the lifetime of the well during injection operations and prior to plugging operations. Should the well require a workover an MIT will also be performed prior to placing the well back into service.

6.2 Testing details

Testing procedures, monitoring equipment details, tolerances, calibration criteria and schedules are described in section B.4 of the QASP.

6.2.1 Annulus Pressure Test (APT)

A successful annulus pressure test (APT) consists of holding a positive annulus pressure of at least 500 psig for a minimum of 60 minutes, with loss or buildup of less than 5 percent of the starting annulus pressure. A minimum annulus differential pressure of 100 psi will be maintained throughout the test.

Pressures will be recorded on a time-drive recorder for at least 60 minutes in the duration and the chart or digital printout of time and pressures will be certified as true and accurate. The pressure scale on the chart will be low enough to readily show a 5 percent change from the starting pressure. In general, the test procedure will be as follows.

1. Connect a high-resolution pressure transducer to the annulus and increase annulus pressure to at least 500 psig or 100 psi over the tubing pressure. Conduct an the APT by holding annular pressure a minimum of 100 psi above the well's maximum permitted surface injection pressure for a minimum of 60 minutes. A minimum annulus differential pressure of 100 psi will be maintained throughout the test.

2. At the conclusion of the APT, annular pressure will be lowered to the well's normal, safe differential pressure value and pressure recording equipment will be removed from the well system.

A successful pressure test will "PASS" if the pressure holds. If the test isn't able to hold pressure for a selected time period, then the test will be considered a "FAIL" and the construction of the well may have lost its integrity. Continuous monitoring of the annulus system will be reviewed to identify if there are any data that may lead to a potential leak and assist in diagnosing potential issues with the annulus. Note: that actual well specific APT procedure will be submitted and approved 30-days prior to testing operations.

6.2.2 Temperature Log

A baseline differential temperature survey will be run in the well after allowing the well a period to reach approximate static conditions. The temperature log is one of the approved logs for detecting fluid movement outside pipe, and a baseline survey will provide an initial curve for future comparisons. The log will include both an absolute temperature curve and a differential temperature curve. The well will be shut-in at least 36 hours to allow for temperature stabilization.

The temperature log will be run over the entire interval of cemented casing, logging down from the surface to TD. A correlation log will be presented in track 1, and the two temperature curves will be presented in tracks 2 and 3. The temperature log will be scaled at or about 20° F (or 10° C degrees) per track. The differential curve will be scaled in a manner appropriate to the logging equipment design but will be sensitive enough to readily indicate anomalies. In general, the procedure will be as follows:

1. Attach a temperature probe and casing collar locator (CCL) to the wireline.

2. After a minimum of 36 hours of well static conditions, begin the temperature survey. The tools will be lowered into the well at 30 to 40 feet per minute, recording temperature in the wellbore. The temperature survey will be run to the deepest attainable depth (top of solids fill) in the wellbore. The wireline may be flagged, if needed, to assist in depth correction.

3. Following completion of the survey, the wireline tools will be retrieved from the wellbore.

A successful temperature log will “PASS” if there are no observed anomalies outside of the permitted injection zone. If anomalies are detected outside of the zone, the test will be considered a “FAIL”, as fluids may have migrated vertically from some point in the well.

If temperature anomalies exist outside of the permitted zone, additional logging may be required to show whether a loss of mechanical integrity is occurring in the injection well. Depending on the nature of the suspected movement, radioactive tracer, noise (oxygen activation), or other logs approved by the UIC Program Director may be required to further define the nature of the fluid movement or to diagnose a potential leak.

7 Pressure Fall-Off Testing

CapturePoint Solutions, LLC will perform pressure fall-off tests during the injection phase as described below to meet the requirements of 40 CFR 146.90(f). Pressure fall-off testing will be conducted upon completion of each injection well to characterize injection formation properties as well as determine near well/reservoir conditions that may have impacts on the injection of CO_2.

7.1 Testing location and frequency

Pressure fall-off testing by CapturePoint Solutions, LLC will occur on a 5-year rotational period, during the injection period of the project within the target injection zone. An initial fall-off test will be run in each well to evaluate formation properties and establish a baseline for data analysis moving forward.

Surface and bottomhole pressure measurements and temperature measurements will be gathered during each test. Positive pressure will be maintained during each testing period.

During the test, monitoring will occur continuously while the injection well is shut-in. The shut-in period will occur long enough to develop a linear decay on a semi-log plot with the collected pressure data. Tests will last between three and five times the time required to reach radial flow conditions.

The results of the pressure fall-off testing via quantitative analysis will be used to estimate formation characteristics such as transmissivity, potential mobility changes and the well skin factor. The well skin factor will be used to identify changes in permeability near the well bore.

A pressure fall-off test will be performed every five years (approximately 45 days of the anniversary of the last test), at a minimum, during the lifetime of injection operations. The UIC Program Director may request more frequent testing which will be dependent on reported test results. A final pressure fall-off test will be run at the cessation of injection for each injection well.

7.2 Testing details

Testing procedures will follow the methodology detailed in "*EPA Region 6 UIC Pressure Fall-off Testing Guideline – Third Revision (August 8,2002)*". Bottomhole pressure measurements near the perforations are preferred due to phase changes with the column of CO_2 in the tubing. A surface pressure gauge may also serve as a monitoring tool for tracking progress of the test.

The pressure gauge can be either installed as part of the completion or can be deployed via a wireline truck. If a wireline truck deployed gauge is used, the wireline should be corrosion resistant (such as MP-35 line) and the deployed gauges should be consist of a surface read-out gauge with a memory backup.

Pressure falloff testing procedure:

1. Record gradient stops while running wireline into the wellbore. Tag and record depth to any fill in the test well.

2. Maintain a constant injection rate in the test well prior to shut-in. The injection rate should be high enough and maintained for a sufficient duration to produce a measurable pressure transient that will result in a valid test.

3. Offset wells, in the same reservoir, will be shut-in during the testing period. If shutting in is not possible, a constant injection rate will be maintained during the test. Following the falloff tests, send at least two pulses to the test well by way of rate changes in the offset well. The pulses will demonstrate communication between the wells and can be analyzed for interference testing.

4. The test well will be shut-in at the wellhead in order to minimize wellbore storage and after flow.

5. Accurate records of rate will be maintained for the test well and adjacent wells during the test.

6. Viscosity of the injectant will be measured periodically during the test to confirm consistency.

In order to make the proper assessment, multi-phase flow conditions will be considered. Results of the pressure fall-off test will be reviewed and included in the semi-annual report. Testing methods, results, and interpretation will be submitted electronically within 30 days of the test per 40 CFR 146.91(e) and 146.91(b)(3).

Each submission will include the following.

1. Location, test name and the date and time of the shut-in period
2. Bottom hole pressure and temperature depths
3. Records of gauges
4. Raw test data in a tabular format (if required by the UIC Program Director)
5. Measured injection rates and pressure data from the test well and any off-set wells completed in the same zone and including data prior to the shut-in period
6. Pressure gauge information (make, model, manufacturer, etc..)
7. Diagnostic curves of test results, noting any flow regimes
8. Description of quantitative analysis of pressure-test results, type of software used and any multi-phase effects
9. Calculated parameter values such as transmissivity, permeability, and skin factor
10. Analysis and comparison of calculated parameter values to previous testing values

11. Identification of data gaps, if any exist
12. Identified necessary changes to the project Testing and Monitoring Plan to ensure continued protection of freshwater zones and USDWs

8 Carbon Dioxide Plume and Pressure Front Tracking

CapturePoint Solutions, LLC will employ direct and indirect methods to track the extent of the carbon dioxide plume and the presence or absence of elevated pressure during the operation period to meet the requirements of 40 CFR 146.90(g). Direct methods will include pressure, and temperature measurements that will be collected from designated monitoring wells and used for analysis. Indirect methods will include gravity surveys of the AoR at specific intervals during injection to track the extent of the CO_2 plume. Information compiled from monitoring will be used to address issues because of injection and used to update the model and simulations to adjust/correct forecasting. The timeframe of the monitoring effort will encompass the entire life cycle of the injection site, and includes the pre-operational (baseline), operational, post operational periods. The methods to characterize the plume are outlined in **Table 11**. The plume and pressure front within the AoR will be characterized and monitored.

Table 11. Plume characterization methods.

Monitoring Location	Monitoring Method	Description	Monitoring Frequency
Direct Monitoring Methods During Injection Operations			
In-Zone Observation Well	Cased hole saturation logs	*Saturation and Temperature*	Annually
In-Zone Monitoring Well	Bottom hole and surface monitoring equipment	*Pressure and Temperature*	Continuous Monitoring
Injection Well(s)	Injection Profile Survey	*Fluid Dispersion and Temperature*	Annually
	Saturation Log	*Pulsed Neutron or Oxygen Activation logs for Determining Saturation*	
Indirect Monitoring Methods During Injection Operations			
AoR	Gravity Survey	*Surface Gravity Field Strength*	Baseline and then every 10 years

8.1 Plume monitoring location and frequency

Table 12 presents the methods that CapturePoint Solutions, LLC will use to monitor the position of the CO_2 plume, including the activities, locations, and frequencies. The parameters to be analyzed as part of fluid sampling in the injection zone and associated analytical methods are presented in **Table 13**. Quality assurance procedures for these methods are presented in the Project/Task Description section A.3 of the QASP. Continuous monitoring of injection rate and pressure will occur at each of the injection wells (NBU CCS 1 and NBU CCS 2) and in-zone pressure at the offset monitoring and observation well. Injection rates, volumes, pressures and temperature will be continuously monitored at the wellheads. Pressure, temperature, and saturation for each injection zone will be conducted at the injection wells and at the in-zone monitoring and observation well. Temperature logs, saturation logs and injection profile surveys will be conducted on an annual basis for each injection well on an annual basis. Monitoring equipment and frequency are described in the attached QSAP. Monitoring of the plume post-injection is detailed in the Post-Injection Site Care and Site Closure Plan. Observed deviations resulting from this monitoring strategy will trigger a revision to the scheduled testing and monitoring schedule.

CapturePoint Solutions, LLC will use direct methods to track the extent of the plume and the presence or absence of elevated pressure throughout the injection period. Observed pressure monitoring data will be tracked and compared to modeling and simulation results. If deviations are detected monitoring frequencies will be adjusted. Fluid sampling and analysis will also occur on a fixed schedule to track changes in fluid composition. If compositional changes are detected sampling frequencies will be adjusted accordingly to determine how the plume is propagating.

The project is targeting the Arbuckle Formation as the injection zone for storage. Stratigraphic details of the identified injection zone are detailed in Figure 2-2 in Site Characterization. From the type-log the Arbuckle begins at approximately 3,443’ below the surface and is approximately 1,072 feet thick.

8.2 Plume Monitoring Details

CapturePoint Solutions, LLC will monitor the CO_2 plume using direct, indirect and estimation methods to satisfy 40 CFR 146.90 (g). Results obtained from this monitoring will be tracked and used to update the AoR every five years or as the result of a detected deviation from permitted operational conditions.

Direct monitoring of the CO_2 plume will require that results from injectivity tests be used to determine the zone that are most likely to receive the bulk of injection. Porosity and permeability data from core analysis in conjunction with the injectivity test results will be used to determine stratigraphically where the injectant is most likely to go. Expected and observed injection volumes will then be extrapolated to the zone to approximate the radial extent of the plume during injection based on volumetric estimation using injection zone thickness, porosity and the injected volume.

During and post injection CapturePoint Solutions, LLC will continuously monitor pressure and temperature at an in-zone monitoring well that is equipped with bottom hole and surface monitoring sensors and gauges. Post-injection reservoir pressure at converted injection well(s) (P_1) will be compared to the measured reservoir pressure at the in-zone monitoring well (P_2). During injection P_1 will be greater than P_2 and when injection stops the reservoir pressure will begin to decrease as it dissipates throughout the formation(s). When P_1 approximates P_2, the pressure front and the CO_2 plume will be considered to have stabilized.

Indirect monitoring of the CO_2 plume will involve the acquisition of gravity surveys to aid in the determination of the CO_2 plume extent. A preliminary survey prior to the start of injection will be run to determine baseline conditions. Subsequent surveys will then be conducted once every 10 years throughout the project or be conducted in the event that the CO_2 plume is detected outside of the AoR.

The combination of both the direct and indirect methods will ensure that injection at the site is operating within permitted conditions and that there is no endangerment to health, the environment or USDWs. Detailed information regarding plume monitoring and tracking is addressed in Module E.4. Post Injection Site Care (PISC) and Site Closure.

Table 12. Plume Monitoring Activities.

Target Formation	Monitoring Activity	Monitoring Location(s)	Spatial Coverage	Frequency
DIRECT PLUME MONITORING				
Arbuckle	Pressure, Temperature, injectivity tests and saturation logs	At in-zone monitoring wells and at injection wells	Data will cover the area of the site that has been impacted by injection	Surface pressure and temperature will be monitored at the well head continuously, injectivity tests – baseline and every 5 years and gravity surveys – baseline and then every 10 years

Table 13. Summary of analytical and field parameters for fluid sampling in the injection zone.

Parameters	Analytical Methods
Arbuckle Formation	
Standard water analysis	Analytical methods are described in the attached QASP **Note:** *Only baseline fluid samples are to be collected and methods are described in the Pre-Operations Testing and Logging Plan*
Isotopic analysis	
Hydrocarbon analysis	

8.3 Pressure-front monitoring location and frequency

Table 14 presents the methods that CapturePoint Solutions, LLC will use to monitor the position of the pressure front, including the activities, locations, and frequencies CapturePoint Solutions, LLC will employ.

Quality assurance procedures for these methods are presented in sections B.2.c and d of the QASP.

CapturePoint will monitor the position of the pressure front and the position of the CO_2 plume based on comparing the temperature and pressures measured in the in-zone monitoring well and injection wells with the prior estimates from the prior reservoir simulation. Additionally results from the fall-off test will be incorporated in the model as appropriate.

8.4 Pressure-front monitoring details

CapturePoint will be monitoring and measuring the surface pressure and temperatures of all injection wells and in-zone pressure and temperature from the in-zone monitoring well. The in-zone monitoring and observation well will be equipped with bottom hole and surface gauges and sensors. The in-zone monitoring well will continuously record pressure and temperature in the injection zone. Additionally, on the stated periodic basis CapturePoint Solutions, LLC will collect bottom hole pressure, temperatures, and fall-off testing data in each of the injection wells.

All the data that is collected between the time the last reservoir simulation was made will be incorporated into the reservoir model which will generate an updated result. The results for all of the basic parameters associated with the location of the CO_2 plume and or the pressure front will be compared between the two models. Any significant deviation between the two models will be investigated to determine the cause of the deviation and how best to improve the reservoir model and/or make operational changes in the field.

Detailed information regarding pressure front monitoring and tracking is addressed in Module E.4. Post Injection Site Care (PISC) and Site Closure.

Table 14 Pressure front monitoring activities.

Target Formation	Monitoring Activity	Monitoring Location(s)	Spatial Coverage	Frequency
DIRECT PRESSURE-FRONT MONITORING				
Injection Formation	Pressure, temperature, saturation log and fluid levels	Offset In-Zone Monitoring well	AoR	Semi-annual reservoir temperature and pressure measurements

<u>E.2 Quality Assurance and Surveillance Plan</u>

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