Underground Injection Control – Class VI Permit Application for

High West CCS Project
Spoonbill No. 001 to 005

St. Charles and Jefferson Parishes, Louisiana

QUALITY ASSURANCE AND SURVEILLANCE PLAN

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LONQUIST

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1. Introduction

High West Sequestration LLC (High West) is planning to develop an integrated carbon capture and sequestration (CCS) project, the High West CCS Project, in St. Charles and Jefferson Parishes, Louisiana. This project is designed to accommodate geologic sequestration for owners of industrial and power facilities seeking to transition to low-carbon products and address environmental, safety, and governance (ESG) goals. This Quality Assurance and Surveillance Plan (QASP) is for operating and monitoring five Class VI CCS well at the High West CCS Project. Additional injection wells may be pursued in the future to increase CO_2 injection into the High West CCS Project area.

This QASP is created to meet the requirements in Statewide Order No. (SWO) 29-N-6 **§3625.A.11**. This plan sets forth the data collection methods and guidelines that will be followed while operating the High West CCS Project. The program describes the standards and procedures used to maintain high quality data. These measurements will provide a level of confidence that injection operations are operating as permitted and not endangering the underground sources of drinking water.

2. Project Organization

The project manager (Project Manager) of the High West CCS Project will be the party responsible for this QASP. In addition, external organizations with unique expertise will be secured. The additional parties with roles and responsibilities involved in the administration and execution are listed below.

- **A third-party testing laboratory** will provide CO_2 and groundwater analysis. They will be responsible for performing sample collection and laboratory measurements.

- **A third-party subsurface monitoring provider** will be responsible for providing expertise and equipment to collect deep monitoring well fluids. They will provide tools, equipment, and internal standard operating procedures.

- **A third-party engineering firm** will provide corrosion coupon monitoring. They will be responsible for performing sample collection and laboratory analysis.

- **A third-party field services provider** will provide well integrity testing services. They will be responsible for all measurement and analysis that is related to integrity evaluation.

- **A third-party logging provider** will provide tools and services to measure physical parameters of the wellbore. They will be responsible for providing data validation, tool calibration and internal standard operating procedures.

- **A third-party coring laboratory** will provide measurements and testing for core sample analysis. The laboratory will provide analytical measurements related to the confining zones and the injection interval.

The Project Manager will be responsible for the supervision of data collection for continuous monitoring, sampling design, testing and well logging carried out at the High West CCS Project. Prior to commencing data collection, the project manager will coordinate with the laboratory, testing, and logging entities to review field, laboratory, and testing roles and responsibilities. This review will also include the documentation and chain-of-custody requirements to minimize potential problems during the project. The Project Manager will also be responsible for ensuring that any changes to this plan will be communicated with relevant parties and a copy is submitted to the appropriate regulatory bodies for approval.

2.1. Problem Definition/Background

The High West CCS Project is located in St. Charles and Jefferson Parishes, Louisiana. The location is ideal for sequestration as the well is located between numerous emitters in South Louisiana, and the subsurface provides ideal geologic conditions. High West plans to sequester 10 MMT/yr of CO_2 into High West CCS Project. To ensure the safety of the environment and to validate that the project is operating as planned, a system of testing and monitoring will be applied. The data collected will be used by the engineers, operators, and regulators. Engineers will use the data to confirm the development of the plume and verify the validity of the model. The operators will use the data to ensure the injection facility is operating within the planned operating window. Regulators will use the data to ensure the project is operating as permitted and verify the safety of the potentially impacted public.

2.2. Project/Task Description and Schedule

The High West CCS Project QASP is subdivided into six major data collection systems. The systems are as follows:

- Continuous Monitoring
- Corrosion Monitoring
- Sampling and Analysis
- Integrity Testing
- Well Logging
- Coring

A continuous monitoring system will collect real-time data. The corrosion monitoring system is designed to collect data that is representative of the metallurgy of the system that will encounter the injection stream. The fluid sampling program will include groundwater and CO_2. Groundwater sampling will provide confidence that the injection project is not interfering with the underground source of drinking water. The CO_2 sampling program will provide information

that will be used to verify the quality of the CO_2 and will be used in the simulation of behavior of the underground plume. The sampling and analysis program will characterize and monitor changes in fluid chemistry and lithology. Lastly, data collected from pressure testing and logging programs will be used to verify the integrity of the well and the integrity of the injection zone. This plan will remain in effect throughout the life of the geologic sequestration project, to include post injection and site closure phases. This QASP will be submitted to the Commissioner of Conservation (Commissioner) for approval. Additionally, this plan will be reviewed annually. Any changes or modifications to any gauges, meters, flowmeters, testing or analytical techniques will require this plan to be amended and submitted to the Commissioner for approval. Once approved, copies will be distributed to all personnel involved in the data collection operations.

3. Instrumentation Summary

The table list below provides a summary of the data collection efforts during the operation of the High West CCS Project. The instruments selected are based on High West's data quality objectives.

Table 1—High West CCS Project Instrumentation Library

Monitoring Location	Instrument Type	Monitoring Target (Formation or Other)	Explanation
CO_2 facility	Injection pressure gauge	CO_2 stream	Injectate pressures will be monitored and recorded using a Supervisory Control and Data Acquisition system (SCADA)
	Temperature gauge	CO_2 stream	Injectate temperatures will be monitored and recorded using a SCADA system
	Coriolis meter	CO_2 stream	Injectate flow rates and volumes will be monitored and recorded using a SCADA system
	Corrosion coupon system	Corrosion	Corrosion coupons will be collected quarterly and sent to an independent laboratory for metal loss analysis
	Surface CO_2 detection	CO_2	Monitor CO_2 concentrations
Third-party laboratory	Pressure gauge	Pressure	Monitor pressure
	Temperature gauge	Temperature	Monitor temperature
	CBL	Cement bond	Monitor cement bond quality
	Casing inspection	Casing thickness	Measure metal loss
	Pump	Pressure	Monitor pump pressure

Monitoring Location	Instrument Type	Monitoring Target (Formation or Other)	Explanation
	Distributed temperature sensing (DTS)	Subsurface	Measure subsurface temperature profile
Injection well	Seismic distributed acoustic sensing (sDAS)	Subsurface	Monitor plume growth
	Pressure temperature gauge	Miocene sands	Monitor injectate pressure and temperature
Monitoring well	Submersible Pump	Above the confining zone	Groundwater quality monitoring

4. Continuous Monitoring

SWO 29-N-6 **§3625.A.2** requires the use of continuous recording devices. The devices provide information that ensures that injection operations stay within permitted parameters. The information collected is also used to validate the growth of the plume and ensure containment within the permitted zone.

4.1. Summary of Data Collection

Temperature, pressure, flow rates, and volumes are measured at the surface. Field gauges and meters will be used to collect this data. Table 2 provides a summary of the data collection efforts for the continuous monitoring requirements.

Table 2—Surface Continuous Monitoring Data Collection Instruments

Activity	Location(s)	Purpose
CO_2 stream analysis	Coupon system	Monitor CO_2 quality
Injection rate and volume	Injection flow line	Mass flow measurement
Injection pressure	Injection tree	Monitor injection pressures
Annular pressure	Annulus access	Monitor annular pressures
Downhole pressure/ temperature	Pressure/Temp gauge ported inside of 7 in. production casing connected to surface via TEC	Monitor injection zone pressure and temperature

Activity	Location(s)	Purpose
Direct Pressure Monitoring	Cemented along production casing at discrete monitoring intervals	Monitor injection interval pressure and temperature
CO_2 gas detection	Wellhead	Monitor ambient CO_2 concentrations

4.2. Downhole Continuous Monitoring Instruments

Permanent downhole monitoring gauges will be installed. Downhole gauges will provide real-time data of the pressure and temperature of the in situ conditions. Table 3 provides gauge specifications for the monitoring instruments. The selected gauges meet and set the standards for data quality objectives. The data quality parameters meet or exceed the requirements for precision, accuracy, measurement range, representativeness, comparability, and completeness of the High West CCS Project. Final vendor select and equipment specifications will meet or exceed those presented.

Table 3—Downhole Gauge Precision, Accuracy, and Measurement Range

Parameter	Value
[redacted]	

Parameter	Value
[redacted]	

4.3. Surface Continuous Monitoring Instruments

Gauges and meters will continuously monitor pressure, temperature, rate and volume, parameters at surface. Tables 4 through 8 provide gauge and meter specifications for the monitoring instruments at surface. The selected gauges meet and set the standards for data quality objectives. The data quality parameters meet or exceed the requirements for precision, accuracy, measurement range, representativeness, comparability, and completeness of the High West CCS Project. Final vendor select and equipment specifications will meet or exceed those presented.

Table 4—Injection Tubing Pressure Gauge, Precision, Accuracy, and Measurement

[redacted]

Table 5—Annulus Pressure Gauge Precision, Accuracy, and Measurement Range

[redacted]

Table 6—Injection Tubing Temperature Gauge Precision, Accuracy, and Measurement Range

[redacted]

Table 7—Mass Flow Rate Meter Precision, Accuracy, and Measurement Range

[redacted]

Table 8—CO_2 Gas Detection

[redacted]

4.4. Data Representativeness

Every location has been selected to best collect a representative measurement of the injection operation.

4.5. Data Completeness

Gauge and meter data will be collected continuously.

4.6. Training Requirements and Certifications

High West will provide training and qualifications for any personnel performing specified tasks during the operation of the facility. Qualification records will be kept and maintained and will be made available for audit.

4.7. Documentation and Records

All calibration and maintenance records will be kept on file in paper and digital format. The continuous monitoring data stream will be collected, transmitted to central site to carry out necessary analysis and control and will be preserved digitally. As required by SWO **§3629.A.4.c.,** all continuous monitoring data will be retained for at least 10 years after collection. Records will be made available upon request during an audit.

4.8. Instrument/Equipment Testing, Inspection, and Maintenance Requirements

All instruments used will be tested, maintained, and inspected as described in Table 9.

Table 9—Instrument Testing, Inspection, and Maintenance Requirements

Equipment Type	Inspection Frequency	Type of Inspection	Maintenance	Testing
[redacted]				

4.9. Instrument Calibration and Frequency

All instruments will be calibrated as described in Table 10. An example of a gauge calibration certificate is provided in Section 12.1 of this plan.

Table 10—Instrument Calibration and Frequency

Equipment Type	Calibration Frequency	Standard Or Calibration Instrument Used
Gauge	Annual	Manufacturer recommendation or equivalent industry standard
Meter	Annual	Manufacturer recommendation or equivalent industry standard

Data is reviewed in real time. Any data found to be outside of normal operating ranges will raise an alarm. The source of the alarm will be immediately investigated and a determination will be made if the data collected is valid or will need to be rejected.

4.10. Data Management

Surface and downhole data will be collected and managed using a Supervisory Control Data and Data Acquisition (SCADA) system. Figure 1 displays a potential data collection arrangement for the downhole monitoring system. The continuous monitoring data stream will be collected, transmitted to central site to carry out necessary analysis and control and will be preserved digitally.

4.11. Reports

Continuous monitoring reports will be compiled monthly. The reports will be distributed to all relevant management parties, and the subsurface CO_2 plume and pressure front modeling team. The reports will be used to adjust the data collection and validation efforts.

5. Corrosion Monitoring

A corrosion monitoring system will be implemented for any metal encountering the injection stream. The coupons will be sent to Stress Engineering Services (or equivalent third-party laboratory) to be tested. Sections below describe QA/QC procedures that will be utilized to collect data that will meet the standards of quality.

5.1. Data Precision, Accuracy, and Measurement Range

Once received by the laboratory, coupons shall be carefully inventoried and photo documented. Coupons shall be nondestructively cleaned and weighed to determine mass loss. Mass shall be measured to the nearest 0.1 mg, and dimensions shall be measured to the nearest 0.025 mm (0.001 in.). Measuring and weighing equipment shall have been calibrated no longer than one year prior to the date of use.

Chemical cleaning may be employed if needed to remove scale and shall be done in accordance with established laboratory procedures. Coupons shall then be examined under optical microscopy for evidence of localized corrosion (such as pitting or crevice corrosion), which shall be documented if present.

5.2. Training Requirements and Certifications

Contractors will be trained in handling and examining corrosion coupons.

5.3. Documentation and Records

As required by SWO 29-N-6 **§3625.B.3.b**, any records collected will contain the following information:

- The date, exact place, and time of sampling or measurements
- The individual(s) who performed the sampling or measurements
- The date(s) analyses were performed
- The individual(s) who performed the analyses
- The analytical techniques or methods used
- The results of such analyses

As required by SWO 29-N-6 **§3629.A.4.**c reports will be kept on physical and digital formats throughout the life of the geologic sequestration project and for the 10 years following site closure.

5.4. Sampling Process Design

Field coupons will be of representative metallurgy as the equipment being monitored. All coupons will be newly prepared, uniquely and indelibly marked (etched or stamped), and their initial masses will be measured. Prior to installation, a record will be started for each coupon that includes the serial number, installation date, installed location in the system, and orientation. The total number of coupons, coupon sizes, and coupon locations will be determined based on the final system design, targeting portions of the system that are at greatest risk of liquid water being present. Coupon holders will be designed such that they are resistant to degradation in the CO_2 stream, regardless of whether water is present. All corrosion coupons are to be individually packaged and carefully handled during both shipment and installation to avoid damage that may affect results.

5.5. Sampling Method Requirements

The project manager will coordinate with the laboratory and sampling collection entities to review field, laboratory, and testing roles and responsibilities. This review will also include the documentation and chain-of-custody requirements to minimize potential problems during the project.

5.6. Sample Handling and Custody Procedures

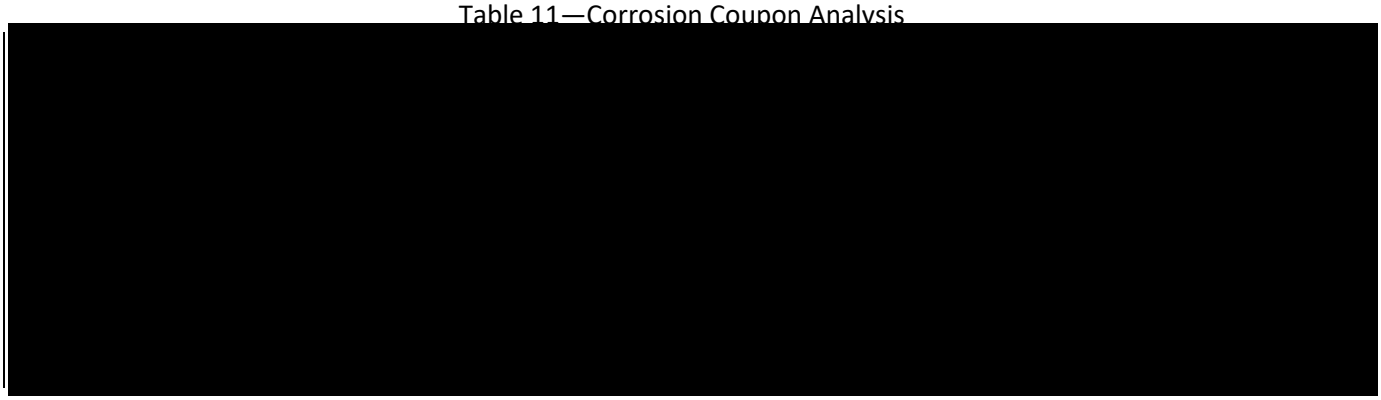
Coupon holders will be designed to be resistant to degradation in the CO_2 stream, regardless of whether water is present or not. All corrosion coupons are to be individually packaged and carefully handled during both shipment and installation to avoid damage that may affect results.

Coupons are planned to be removed and replaced on a quarterly basis, in accordance with SWO 29-N-6 **§3625.A.3**. As with installation, coupon removal will be done carefully to avoid damage. No coupon cleaning or coating is to be done in the field. Upon removal, the corrosion coupon report for each coupon will be updated with the removal date, initial observations, and any pertinent information about operations during the time the coupon was in place. Coupons will be individually photographed, protected in moisture-free packaging, and immediately shipped to the test laboratory for evaluation.

Standard chain-of-custody procedures will be followed, and records maintained to allow a full reconstruction of how the samples were collected, stored, and transported, including any problems encountered.

5.7. Analytical Methods Requirements

Table 11—Corrosion Coupon Analysis



5.8. Quality Control Checks

Measuring and weighing equipment shall have been calibrated no longer than one year prior to the date of use.

5.9. Reports

Stress Engineering Laboratories, or an equivalent laboratory, will generate a corrosion coupon report. High West will review the report and verify that no significant metallurgic changes have been observed. If significant changes are observed, an investigation into the source will be launched and remediation efforts will begin. Mass loss should be considered for information only, and any evidence of localized corrosion warrants review by a subject matter expert to provide recommendations. The corrosion resistant alloy (CRA) portions of the system are designed to resist corrosion damage entirely, so if there is pitting on the coupons, it will need to be reviewed. Tightening up test frequency would not be helpful and may even mask the damage since there is a nucleation time associated with the pitting mechanism. The report will be submitted to the required regulatory bodies along with the semi-annual reports.

5.10. Sampling Process

Corrosion coupons made of the same material as the production casing and the injection tubing will be placed in the CO_2 injection pipeline. The coupons will be removed quarterly and assessed for corrosion using American Society for Testing and Materials (ATSM) standards for evaluating corrosion tests. When the coupons are removed, they will be inspected visually for any signs of corrosion, including pitting. The weight and size of the coupons will be measured each time they are removed. The rate of corrosion will be calculated using a weight loss method where the rate equals the weight loss during the exposure period divided by the duration of the period.

5.11. Laboratory Analysis

Once received by the laboratory, coupons will be carefully inventoried and photo documented. Coupons will be nondestructively cleaned and weighed to determine mass loss. Chemical cleaning may be employed if needed to remove scale and shall be done in accordance with established laboratory procedures. Coupons will then be examined under optical microscopy for evidence of localized corrosion (such as pitting or crevice corrosion), which will be documented if present. Results will be reviewed by subject matter experts, documented on the corrosion coupon reports, and delivered to the operator for review. Mass loss should be considered for information only, and any evidence of localized corrosion warrants review by a subject matter expert to provide recommendations. Any additional examinations of the coupons will be considered on a case-by-case basis.

5.12. Record Keeping

Results will be reviewed by subject matter experts, documented on the corrosion coupon reports, and delivered to the operator for review. Any additional examinations will be considered on a case-by-case basis.

All coupon sampling history and analysis will be kept on file. They will remain active during the life of the project.

6. Groundwater and CO_2 Sampling and Analysis

Table 12 — High West CCS Project Sampling Summary

Activity	Location	Method	Analytical Technique	Lab/Custody	Purpose
[redacted]					

Activity	Location	Method	Analytical Technique	Lab/Custody	Purpose
[redacted]					

6.1. CO_2 Stream Analysis

CO_2 Stream analysis will be conducted by [redacted] or an equivalent third-party laboratory. The sections below describe QA/QC procedures that will be utilized to collect data that will meet the standards of quality.

Table 13 — CO_2 Precision, Analysis, and QC Requirements

Parameters	Analytical Methods	Detection/limit Range	Typical Precisions	QC Requirements
[redacted]				

Parameters	Analytical Methods	Detection/limit Range	Typical Precisions	QC Requirements
[redacted]				

6.1.1. Training Requirements and Certifications

An EPA-Certified laboratory will be used for all sample analysis.

6.1.2. Documentation and Records

As required by SWO 9-N-6 **§3625.B.3.b**, any records collected will contain the information:

- The date, exact place, and time of sampling or measurements
- The individual(s) who performed the sampling or measurements
- The date(s) analyses were performed
- The individual(s) who performed the analyses
- The analytical techniques or methods used
- The results of such analyses

6.1.3. Sampling Method Requirements

The Project Manager will coordinate with the laboratory and sampling collection entities to review field, laboratory, and testing roles and responsibilities. This review will also include the documentation and chain-of-custody requirements to minimize potential problems during the project.

6.1.4. Sample Handling and Custody Procedures

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

6.1.5. Analytical Methods Requirements

Analytical methods are presented in Table 13.

6.1.6. Quality Control Checks

QC Methods are presented in Table 13.

6.1.7. Reports

Element Laboratories, or an equivalent laboratory, will generate a report. High West will review the report and verify that no significant geochemical changes have been observed. The report will be submitted to the required regulatory bodies along with the semi-annual reports.

6.1.8. Sampling Procedures

The project manager will coordinate with the laboratory, sampling collection, and formation tester service representatives, to review field, laboratory, and testing roles and responsibilities. This review will also include the documentation and chain-of-custody requirements to minimize potential problems during the project.

6.1.9. Record Keeping

As required by SWO 29-N-6 **§3629.A.4.a** reports will be kept on physical and digital formats throughout the life of the geologic sequestration project and for the 10 years following site closure.

6.2. Water Analysis

6.2.1. Formation Fluid Analysis

A wireline formation tester service will be acquired. Valid calibration certificates and tool specifications will be requested before selecting service.

Table 14—Formation Sample Precision and Analysis

Analyte	Method	Reporting Limit	MDL	Precision*	QC requirements
[redacted]					

Analyte	Method	Reporting Limit	MDL	Precision*	QC requirements
[redacted]					

Precision= LCS control limits*
Additional sample volume required for Field Duplicate, Matrix Spike, Matrix Spike Duplicate samples

6.2.2. Training Requirements and Certifications

An LELAP-Certified laboratory will be used for all sample analysis.

6.2.3. Documentation and Records

As required by SWO 29-N-6 **§3625.B.3.b**, any records collected will contain the following information:

- The date, exact place, and time of sampling or measurements
- The individual(s) who performed the sampling or measurements
- The date(s) analyses were performed
- The individual(s) who performed the analyses
- The analytical techniques or methods used
- The results of such analyses

As required by SWO 29-N-6 **§3629.A.4.a**, reports will be kept on physical and digital formats throughout the life of the geologic sequestration project and for the 10 years following site closure.

6.2.4. Sampling Process Design

Prior to setting the production casing string, samples of the formation fluid will be obtained by running an open hole fluid recovery tool. Recovery sections will be determined based on open hole evaluations. Two samples will be taken per section as described in the *Drilling and Completion Prognosis*, *Appendix F*.

6.2.5. Sampling Method Requirements

The project manager will coordinate with the laboratory, sampling collection, and formation tester service representatives, to review field, laboratory, and testing roles and responsibilities. This review will also include the documentation and chain-of-custody requirements to minimize potential problems during the project.

6.2.6. Sample Handling and Custody Procedures

Formation fluid samples will be sent to an approved laboratory. Standard chain-of-custody procedures will be followed, and records maintained to allow a full reconstruction of how the samples were collected, stored, and transported, including any problems encountered.

Table 15 — Container, Preservation Methods, and Holding Times

Analyte	Container	Preservation	Holding Time
[redacted]			

Analyte	Container	Preservation	Holding Time
[redacted]			

6.2.7. Analytical Methods Requirements

Formation fluid analysis is presented in Table 14.

6.2.8. Quality Control Checks

Formation fluid QC is presented in Table 14.

6.2.9. Reports

Element Laboratories, or an equivalent laboratory, will generate a report. High West will review the report and verify that no significant geochemical changes have been observed. The report will be submitted to the required regulatory bodies along with the semi-annual reports.

6.2.10. Groundwater Monitoring Analysis

Above zone monitoring will be conducted using a deep monitoring well. The sections below describe QA/QC procedures that will be utilized to collect data that will meet the standards of quality.

Table 16—Groundwater Sample Precision and Analysis

Analyte	Method	Reporting Limit	MDL	Precision*	QC requirements
[redacted]					

Analyte	Method	Reporting Limit	MDL	Precision*	QC requirements
[redacted]					

Precision= LCS control limits*
Additional sample volume required for Field Duplicate, Matrix Spike, Matrix Spike Duplicate samples

6.2.11. Training Requirements and Certifications

An EPA-Certified laboratory will be used for all sample analysis.

6.2.12. Documentation and Records

As required by SWO 29-N-6 **§3625.B.3.b,** any records collected will contain the following information:

- The date, exact place, and time of sampling or measurements
- The individual(s) who performed the sampling or measurements
- The date(s) analyses were performed
- The individual(s) who performed the analyses
- The analytical techniques or methods used
- The results of such analyses

Additionally, as required by SWO 29-N-6 **§3629.A.4.a** , reports will be kept on physical and digital formats throughout the life of the geologic sequestration project and for the 10 years following site closure.

6.2.13. Sampling Process Design

Fluid samples in the groundwater monitoring well will be collected at the monitored formation temps and maintained at the formation pressures within a pressurized sample container to prevent any losses of dissolved gases. Prior to sampling, the well will be purged of any fluid stored in the well bore. Static fluid level and temperature will be measured prior to purging the well. A U-tube sampling system will be lowered to the monitored zone via wireline or slickline and the rate of sample collection should not exceed the rate at which the well was purged.

Class VI Solutions, Inc., or an equivalent laboratory, will be engaged to provide sampling services. Example detailed sampling processes can be found in Section 0 of this document.

The project manager will coordinate with the laboratory and sampling collection entities to review field, laboratory, and testing roles and responsibilities. This review will also include the documentation and chain-of-custody requirements to minimize potential problems during the project.

6.2.14. Sampling Method Requirements

The project manager will coordinate with the laboratory, sampling collection, and formation tester service representatives, to review field, laboratory, and testing roles and responsibilities. This review will also include the documentation and chain-of-custody requirements to minimize potential problems during the project.

6.2.15. Sample Handling and Custody Procedures

Table 17—Container, Preservation Methods, and Holding Times

Analyte	Container	Preservation	Holding Time
[redacted]			

Analyte	Container	Preservation	Holding Time
[redacted]			

6.2.16. Analytical Methods Requirements

Formation fluid analysis is presented in Table 16.

6.2.17. Quality Control Checks

Formation fluid QC is presented in Table 16.

6.2.18. Reports

Element Laboratories, or an equivalent laboratory, will generate a report. High West will review the report and verify that no significant geochemical changes have been observed. The report will be submitted to the required regulatory bodies along with the semi-annual reports.

7. Integrity Testing

Temperature, pressure, flow rates, and volumes will be measured. Field gauges and meters will be used to collect this data. The sections below provide instrumentation specifications and operating details. The selected gauges meet and set the standards for data quality objectives. The data quality requirements will cover the following testing routines:

- Annulus pressure test
- Pressure fall-off testing
- Step-rate injectivity test

The data quality parameters meet or exceed the requirements for precision, accuracy, measurement range, representativeness, comparability, and completeness of the High West CCS Project.

7.1. Data Precision, Accuracy, Measurement Range

Table 18—Tubing Pressure Testing Precision, Accuracy, and Measurement

Parameter	Value
[redacted]	

Table 19—Annulus Pressure Testing Precision, Accuracy, and Measurement Range

Parameter	Value
[redacted]	

Table 20—Downhole Pressure Gauge Precision, Accuracy, and Measurement Range

Parameter	Value
[redacted]	

7.2. Training Requirements and Certifications

Training and qualifications for any personnel performing covered tasks will be provided before participating in operations. Qualification records will be kept and maintained and will be made available for audit.

7.3. Instrument/Equipment Testing, Inspection, and Maintenance Requirements

Table 21—Instrument Testing, Inspection, and Maintenance Requirements

Equipment Type	Inspection Frequency	Type of Inspection
[redacted]		

7.4. Instrument Calibration and Frequency

Table 22—Testing Instrument Calibration

Equipment Type	Calibration Frequency	Standard Or Calibration Instrument Used
Gauge	Annual	Manufacturer recommendation or equivalent industry standard
Meter	Annual	Manufacturer recommendation or equivalent industry standard

7.5. Reports

Reports will be compiled after testing. The reports will be kept on file in physical and digital formats. Complete reports will be distributed to management and required regulatory bodies.

7.6. Data Review, Validation, and Verification

The data collected from any integrity testing will be reviewed by the responsible third-party using company and equipment standard operating procedures internal data validation and verification processes.

The Project Manager will coordinate with the testing service representatives to review field and testing roles and responsibilities. This review will also include the documentation and chain-of-custody requirements to minimize potential problems during the project.

7.7. Calibration Procedures

Service companies will provide gauges that will be used for testing. All gauges that will be used in testing will need to have current calibration records. These records will be kept on file and will remain active during the life of the project.

7.8. Record Keeping

All records pertaining to integrity testing will be kept in physical and digital format. As required by SWO 29-N-6 **§3629.A.4.a**, reports will be kept on physical and digital formats throughout the life of the geologic sequestration project and for the 10 years following site closure.

8. Well Logging

Logging services will be secured through a selection process that will be determined by availability, current technology, and expertise. All logging services will be assessed for data quality standards conformance before selection.

Table 23—Well Logging Methods to be Employed

Activity	Location(s)	Method	Purpose
[redacted]			

8.1. Data Precision, Accuracy, Measurement Range

Logging tool service providers will provide tool precision, accuracy, and measurement ranges upon solicitation of services.

The Project Manager will coordinate with the laboratory, testing, and logging entities to review field, laboratory, and testing roles and responsibilities. This review will also include the documentation and chain-of-custody requirements to minimize potential problems during the project.

8.2. Instrument/Equipment Testing, Inspection, and Maintenance Requirements

The logging tool service providers will be responsible for maintaining equipment, testing, and inspection of measurement devices. Certification of these activities will need to be provided from the service provider before commencing data collection activities at the High West CCS Project.

8.3. Instrument Calibration and Frequency

The logging tool service providers will be responsible for calibration of measurement devices. Certificates of calibration will need to be provided from the service provider before commencing data collection activities at the High West CCS Project.

8.4. Data Acquisition Requirements

The logging tool service providers will be responsible for data acquisition requirements. Standard industry practices will be applied.

8.5. Reports

Reports will be compiled after logging. The reports will be kept on file in physical and digital formats. Complete reports will be distributed to management and required regulatory bodies. Reports will be submitted to the required regulatory bodies along with the semi-annual reports.

8.6. Data Review, Validation, and Verification

The data collected from any logging activities will be reviewed by the responsible third-party using company and equipment standard operating procedures and internal data validation and verification processes.

8.7. Record Keeping

A copy of all instrument certification and calibration will be kept on file. Reports generated from data collection activities will be compiled and disseminated to all interested parties. As required by SWO 29-N-6 **§3629.A.4.a** reports will be kept on physical and digital formats throughout the life of the geologic sequestration project and for the 10 years following site closure.

9. Coring

SWO 29-N-6 **§3617.B.2** requires cores to be taken from the injection zone and the confining system. Cores will be taken in the stratigraphic test well from the zones identified in Table 24.

Table 24—Coring Plan

Zone	Interval Top (ft TVD)	Interval Base (ft TVD)	Whole Core Interval (TVD ft)	Testing Program
[redacted]				

Table 25 and Table 26 describe the analysis and the testing standards that will be implemented.

Table 25—Injection Interval Core Analyses

[redacted]

[redacted]

Table 26—Confining Interval Core Analyses

[redacted]

9.1. Reports

As required by SWO 29-N-6 **§3617.B.2**a detailed report prepared by a log analyst will be submitted that includes well log analyses, core analyses, and formation fluid sample information.

9.2. Record Keeping

A copy of all instrument certification and calibration will be kept on file. Reports generated from data collection activities will be compiled and disseminated to all interested parties. As required by SWO 29-N-6 **§3629.A.4.a** reports will be kept on physical and digital formats throughout the life of the geologic sequestration project and for the 10 years following site closure.

10. Packer

[redacted]

10.1. Instrument/Equipment Testing, Inspection, and Maintenance Requirements

Annular tests designed to prove the mechanical integrity of the casing, tubing, and packer will be completed in accordance with SWO 29-N-6 **§3627.A.1.a** when the well is completed, before the start of injection, and after any workover operation involving the removal and replacement of the tubing and packer. These tests will be conducted by pressuring the annulus to a minimum of 500 pounds per square inch (psi) fluid pressure, then using a block valve to isolate the test pressure source from the test pressure gauge upon test initiation, with all ports into the casing annulus closed except the one monitored by the test pressure gauge. The test pressure will be monitored and recorded for at least 30 minutes using a pressure gauge with sensitivities that can indicate a loss of 5%. Any loss of test pressure exceeding 5% during the minimum 30 minutes will indicate a lack of mechanical integrity.

All annulus pressure test results will be submitted to the TRRC/EPA on Form H-5 within 30 days of log run completion. This test will be performed at a minimum of every 5 years.

10.2. Record Keeping

A copy of all annular pressure tests will be kept on file. Reports generated from data collection activities will be compiled and disseminated to all interested parties. As required by SWO 29-N-6 **§3629.A.4.a**, reports will be kept on physical and digital formats throughout the life of the geologic sequestration project and for the 10 years following site closure.

11. Instrument Specification Sheets

The instruments and devices identified in this document may vary by vendor based on well planning, technology developments and vendor availability. All final instruments selected will meet or exceed the equipment identified in this document.