Plan Revision Number: 1
Plan Revision Date: 10/31/2024

QUALITY ASSURANCE AND SURVEILLANCE PLAN

South Texas Sequestration Project (Kleberg Hub)

1.0 Facility Information

Facility name: South Texas Sequestration Project (Kleberg Hub)
Well Names: Becerra_CCS_01_01, Becerra_CCS_01_02, Becerra_CCS_02_01, Becerra_CCS_02_02, Garcias_CCS_01_01, Garcias_CCS_01_02

Facility contact: [redacted], Project Manager
5 Greenway Plaza, Suite 110, Houston, TX 77046
[redacted]

Well location: Kleberg County, Texas

WELL_NAME	LAT_NAD27	LONG_NAD27
Becerra_CCS_01_01	[redacted]	[redacted]
Becerra CCS 01 02	[redacted]	[redacted]
Becerra _CCS_02_01	[redacted]	[redacted]
Becerra _CCS_02_02	[redacted]	[redacted]
Garcias CCS 01 01	[redacted]	[redacted]
Garcias_CCS_01_02	[redacted]	[redacted]

2.0 Project Management and Surveillance Process

The South Texas Sequestration Project (Kleberg Hub or Project) is supported by a multidisciplinary team from Kleberg Sequestration Hub, LLC (1PointFive), consultants, and subcontractors. Each team will provide technical expertise for safe, successful, and efficient operations.

Characterization of the reservoirs, seals, and subsurface features has been done by experienced geoscience professionals using industry-recognized simulation software and techniques. Further characterization of the features will be done by applying logging and testing technologies during the drilling of the Project wells.

Pipeline, surface equipment, and well designs comply with industry standards for CO_2 material selection and operating conditions to promote mechanical integrity of the system during the life of the Project.

Monitoring programs for leak detection, corrosion, and surveillance have been tailored for operations at the Project to protect USDW, human health and the environment, maintain mechanical integrity of the installation during operations, and maximize the storage life of the asset. These plans incorporate best practices and recommendations for carbon capture and storage projects as well as Occidental's (Oxy) decades of experience in the development of CO_2 enhanced oil recovery (EOR) fields.

As part of the quality control process during testing and surveillance, most of the samples collected and the data gathered will be analyzed, processed, validated, or witnessed by third parties independent of the Project operations staff. For specialized data such as seismicity and distributed temperature sensing (DTS), the Project will have additional support from the providers of the selected technologies in quality control, verification of the data, and system calibration.

Sensors, transducers, and controllers will be connected to a central platform to allow for monitoring of operating conditions, system upset alarming, and safety protocol initiation. System data interfaces will be created and integrated into a surveillance platform. The operating parameters, monitoring values, laboratory results, and surveillance documents for the project will be stored in a central database to provide support for AoR reviews, quality assurance programs, and reporting.

The Project will establish key staffing positions for reliable operation and high quality, surveillance procedures, storage evaluation, and reporting. Some of the staff will be dedicated full time to the operation, while others will be assigned as required during AoR reviews, maintenance activities, and other project activities.

Once the Project is in operation, 1PointFive will provide an updated contact list with the names of the individuals in each position. The list will then be updated upon request.

2.1. Project/Task Organization

2.1.1 Key Individuals and Responsibilities

A brief description of the project organization is below:

The Project is led by the Vice President (VP) of Oxy Low Carbon Ventures (OLCV), who is responsible for the overall execution of the Project. Reporting to the VP are the Director Subsurface Evaluation and the Director Ops and Tech Support

Director Subsurface Evaluation OLCV: This Director is responsible for subsurface activities for the Project, including geological and reservoir modeling, petrophysics, and geophysics. They are responsible for analyzing the site and designing subsurface safety based on various modeling assumptions regarding carbon capture and storage.

Director Operations and Tech Support: This Director plays a central role in the implementation of all data gathering and analysis for the CO_2 Pipeline and Storage Project. This Director provides overall coordination and responsibility for organizational and administrative aspects of the project and is also responsible for the planning, funding, schedules, and controls needed to implement project plans and ensure that project participants adhere to the plan.

Director Commercial Development: This Director plays an important role in enlisting emitters seeking to sequester CO_2. This individual negotiates the commercial agreements with the various parties on financial terms mutually agreeable to the parties. In addition, Commercial Services is responsible for providing financial assurance for the expenses required during post-injection site care and site closure.

Project Manager: The Project Manager is responsible for project implementation after pore space characterization and project commercial contracting is complete. This role is responsible for coordinating the Class VI permitting process, other environmental and project permit approvals, drilling of the wells, facility installation, and project commissioning and startup.

Facilities Engineer: The role of the Facilities Engineer (FE) is to identify quality-affecting processes and monitor compliance with project requirements. The FE is responsible for establishing and maintaining the project quality assurance plans, monitoring project staff compliance with them, and ensuring that this Quality Assurance and Surveillance Plan (QASP) meets the Project's quality assurance requirements.

Drilling/Production Engineer: The role of the Drilling/Production Engineer is to design and implement the drilling of the injection and various monitoring wells, including obtaining budget pricing information, design of the wellbores, and developing the monitoring programs for the wells involved. One additional responsibility is to review the existing penetrations within the proposed CO_2 plume and pressure front and provide a plan for remediation, as needed.

Reservoir Engineer: The role of the Reservoir Engineer is to gather subsurface data and run the simulation model to predict the pressure front and CO_2 plume movement. This person must work closely with the other subsurface staff to achieve accurate results with the data available.

Geologist: The role of the Geologist is to define the subsurface storage area, to create a geologic model, and incorporate the seismic and petrophysical data into the model.

Petrophysicist: The role of the Petrophysicist is to analyze the available logs and generate porosity and permeability models to be used in developing the Project subsurface model.

Geophysicist: The role of the Geophysicist is to help define the subsurface storage area by analyzing the available 2D and 3D seismic images of the area and interpreting faults or other areas that could potentially be leakage pathways.

Subject Matter Experts/Task Leads: Well testing and monitoring Subject Matter Experts (SMEs) and Task Leads comprise both internal and external (subcontractors) geologists, hydrologists, chemists, atmospheric scientists, ecologists, and others as may be required. These SMEs help to develop testing and monitoring plans, collect environmental data specified in those plans, and maintain and update those plans as needed.

Table QASP-1—Contact List

Name	Organization	Project Role(s)	Contact Information (Telephone / Email)
[redacted]	Occidental Oil & Gas Corporation	VP Low Carbon Venture Services Low Carbon Venture Services	[redacted]
	Occidental Oil & Gas Corporation	Director Subsurface Evaluation Low Carbon Venture Services	
	Occidental Oil & Gas Corporation	Director Ops and Tech Support Low Carbon Venture Services	
	Occidental Oil & Gas Corporation	Director Commercial Development / Project Manager Low Carbon Ventures	
	Occidental Oil & Gas Corporation	Geoscience Lead Subsurface	
	Occidental Oil & Gas Corporation	Engineer Consultant Prod Ops LCVS – Ops & Tech Support	
	Occidental Oil & Gas Corporation	Eng Advisor Reservoir Sr LCVS – Subsurface Evaluation	
	Occidental Oil & Gas Corporation	Petrophysical Advisor Sr LCVS – Subsurface Evaluation	
	Occidental Oil & Gas Corporation	Geological Advisor LCVS – Subsurface Evaluation	
	Occidental Oil & Gas Corporation	Geophysical Advisor Sr LCVS – Subsurface Evaluation	
	Occidental Oil & Gas Corporation	Director Projects (Facilities) LCVS – Ops & Tech Support	
	Occidental Oil & Gas Corporation	Subject Matter Experts and Task Leads	

2.1.2 Independence from Project QA Manager and Data Gathering

The majority of the physical samples collected, and data gathered as part of the monitoring program was analyzed, processed, or witnessed by independent third parties who are outside of the project management structure.

2.1.3 QA Project Plan Responsibility

1PointFive will be responsible for maintaining and distributing official, approved QA project plans.

2.2. Data Verification and Validation

The Project will establish a standardized program for data acquisition and validation methods. The program will verify that collected data is reasonable, processed and analyzed correctly, and reviewed for errors. Peer reviews or third-party consultants will provide quality control. Issues identified during a peer review will be addressed and corrected by the data owner. Errors identified in the data will be corrected, and affected users will be notified. Corrective actions will be coordinated to mitigate and address any impacts from data errors.

2.3 Management of Change

The Project will implement a Management of Change (MOC) procedure to communicate and document any deviation from policies, operational parameters, and standard operating procedures. The MOC procedure aims to mitigate deviations in cost and project scope.

2.4 Contractor Requirements

Each contractor will follow a qualification process before being authorized to execute work on site or in their shop. Each contractor providing service to the Kleberg Hub must provide a copy of their Quality Assurance / Quality Control (QA/QC) and safety management program to qualify for performing the work. Contractors may be audited by the 1PointFive and its SMEs and safety representatives. All contractors are required to comply with the Worker Safety Program and Operations policies at the work site. 1PointFive reserves the right to inspect and audit the contractor's operation and quality program for compliance with safety and QA/QC programs.

2.5 Special Training and Certificates

Wireline logging, indirect geophysical methods, and non-routine sampling will be performed by trained, qualified, and certified personnel.

Routine injectant and groundwater sampling will be performed by trained personnel, but no specialized certifications are required. Some special training will be needed for project personnel, particularly in the areas of PNC logging interpretation, certain geophysical methods, certain data acquisition and transmission systems, and certain sampling technologies.

Training of project staff will be conducted by project personnel knowledgeable in project-specific sampling procedures. Training documentation will be maintained as project QA records.

2.6 Documentation, Records, and Reporting

All data and project records will be stored electronically on secure servers and will have routine backups. Reporting will comply with Class VI UIC requirements.

The sections of the QASP listed below are under development at the time of the initial submittal. All testing and monitoring techniques and other procedures set forth below are subject to change based on actual operations and technical, operational, and safety concerns encountered. Minor deviations from the procedures below may be required and should not be considered non-compliance with the terms of the Project permit.

3.0 Testing and Monitoring Techniques

Calibration and quality control of the tools will follow the service provider's protocols and procedures.

3.1 Cement Bond Log and Variable Density Log

For cement quality evaluation, the monitoring plan in Attachment C proposes using cement bond logs (CBL) and variable density logs (VDL). Table QASP-2 provides the basic data for each tool.

3.1.1 Tool Specifications

Table QASP-2: CBL/VDL Specifications

CBL/VDL Tool Specifications	
	[redacted]
Recommended Logging Speed (ft/min)	
Maximum Logging Speed (ft/min)	
Max Temperature (°F)	
Max OD (in)	
Length (in)	

Max Pressure (psi)	[redacted]
Min Csg/Tbg ID (in)	
Max Csg/Tbg OD (in)	
Weight (lbs)	
Vertical Resolution (ft)	
Borehole Fluid	
Tool Positioning	
Vertical Resolution (ft) - Sonic Waveform	
Vertical Resolution (ft) - E_1 Peak Amp	

These activities are executed by specialized contractors with proven industry technology. Calibration and quality control of the tools will follow the service provider's protocols and procedures.

3.1.2 CBL/VDL Log Running Procedure

1. Move in wireline unit
2. Ensure wellbore is filled with treated water
3. Make sure the wellhead valve is in closed position. Remove top cap, rig up 10k grease injection wireline pressure control equipment (PCE) for attachment to wellhead. A crane will be required to rig up wireline unit.
4. Rig up CBL/VDL tool string
5. Inspect all connections, accessories and conduct surface tool checks
6. Lift tool string into PCE using wireline
7. Connect PCE to wellhead and equalize the lubricator
8. Open the wellhead valve and lower tools into wellbore
9. Run in hole to desired depth
10. Pressure casing up to 500psi (optional)
11. Log up at vendor recommended speed over area of interest
12. POOH, bleed off lubricator, lay down and rig down CBL/VDL tool string

3.2 Electromagnetic and Ultrasonic Cement and Casing Evaluation Tools

For mechanical integrity evaluation, the monitoring plan in Attachment C proposes using ultrasonic and electromagnetic tools that evaluate the conditions of the tubulars in the well and provide information about thickness, ovality, ruptures, and potential corrosion. Table QASP-3 provides the basic data for each tool.

3.2.1 Tool Specifications

Table QASP-3: Tool Data Sheet Summary

Logging Type	Isolation Scanner	USIT	EM Pipe Xaminer	EM Pipe Scanner	CAST-XR
Acquisition	[redacted]				
Logging speed					
Thickness measurement accuracy					
Range of measurement					
Mud type limitations					
Temperature rating					
Pressure rating					
Casing size minimum					
Casing size maximum					
Outside diameter					
Length					
Weight					

1st Pipe defect detection accuracy	[redacted]
1st Pipe (2Cs) accuracy	
Total metal thickness 1.2 in. (3Cs) overall average	
Total metal thickness 1.8 in. (4Cs) overall average	

These activities are executed by specialized contractors with proven industry technology. Calibration and quality control of the tools will follow the service provider's protocols and procedures.

3.2.2 Ultrasonic/Electromagnetic Log Running Procedure

1. Move in wireline unit
2. Ensure wellbore is filled with treated water
3. Make sure the wellhead valve is in closed position. Remove top cap, rig up 10k grease injection wireline pressure control equipment (PCE) for attachment to wellhead. A crane will be required to rig up wireline unit.
4. Rig up ultrasonic/electromagnetic tool string
5. Inspect all connections, accessories and conduct surface tool checks
6. Lift tool string into PCE using wireline
7. Connect PCE to wellhead and equalize the lubricator
8. Open the wellhead valve and lower tools into wellbore
9. Run in hole to desired depth
10. Log up at vendor recommended speed over area of interest
11. POOH, bleed off lubricator, lay down and rig down ultrasonic/electromagnetic tool string

3.3 Temperature Log

To help locate gas entries, detect casing leaks and evaluate fluid movement behind casing in monitoring wells, the monitoring plan in Attachment C proposes using temperature logs. Table QASP-4 provides the basic data for each tool.

3.3.1 Tool Specifications

Table QASP-4: [redacted] (Temperature) Specifications

Halliburton BHPT-I Specifications	
Maximum Temperature	[redacted]
Maximum Pressure	
Maximum OD	
Tool Length	
Minimum Hole ID	
Maximum Hole ID	
Borehole Fluids	
Tool Positioning	
Maximum Logging Speed	
Pressure Measurement Range	
Temperature Measurement Range	
Resistivity Measurement Range	
Pressure Resolution	
Temperature Resolution	
Resistivity Resolution	

These activities are executed by specialized contractors with proven industry technology. Calibration and quality control of the tools will follow the service provider's protocols and procedures.

3.3.2 Temperature Log Running Procedure

1. Move in wireline unit
2. Make sure the wellhead valve is in closed position. Remove top cap, rig up 10k grease injection wireline pressure control equipment (PCE) for attachment to wellhead. A crane will be required to rig up wireline unit.
3. Rig up temperature tool string
4. Inspect all connections, accessories and conduct surface tool checks
5. Lift tool string into PCE using wireline
6. Connect PCE to wellhead and equalize the lubricator
7. Open the wellhead valve and lower tools into wellbore
8. Run in hole to desired depth
9. Log up at vendor recommended speed over area of interest
10. POOH, bleed off lubricator, lay down and rig down temperature tool string

3.4 Pulse Neutron Log

The Pulsed Neutron log is considered a proven technique to detect gas saturation in reservoirs. Advances in the technology have improved the accuracy of the tool for tracking movement of CO_2 plumes in the reservoir and evaluating flow conformance. Table QASP-5 shows the basic specification of the tools.

3.4.1 Tool Specifications

Table QASP-5: Basic Tool Specifications

Logging Type	Pulsar – Neutron [redacted]	TMD3D Pulsed Neutron [redacted]
Acquisition	Real Time	Real Time
Logging speed	200 to 3,600 ft/h	60 to 1,800 ft/h

Depth of investigation	[redacted]
Vertical resolution	
Range of measurement	
Mud type limitations	
Temperature rating	
Pressure rating	
Casing size minimum	
Casing size maximum	
Outside diameter	
Length	
Weight	

These activities are executed by specialized contractors with proven industry technology. Calibration and quality control of the tools will follow the service provider's protocols and procedures.

3.4.2 Pulse Neutron Log Running Procedures

1. Move in wireline unit
2. Make sure the wellhead valve is in closed position. Remove top cap, rig up 10k grease injection wireline pressure control equipment (PCE) for attachment to wellhead. A crane will be required to rig up wireline unit
3. Equalizing: if possible the lubricator should be equalized with a standalone CO2 source/test pump rather than from the wellbore via needle valve
4. Rig up pulse neutron tool string
5. Inspect all connections, accessories and conduct surface tool checks
6. Lift tool string into PCE using wireline
7. Connect PCE to wellhead and equalize the lubricator
8. Open the wellhead valve and lower tools into wellbore
9. Function test tools and conduct any calibrations while running in hole
10. Log over known wet zone first if one is available

11. Proceed to PBTD with tool string being careful not to spud tool string into PBTD
12. Upon reaching PBTD, log 3 passes over area of interest at vendor recommended speed in C/O mode
13. Proceed to PBTD with tool string being careful not to spud tool string into PBTD
14. Upon reaching PBTD, log 1 pass over area of interest at vendor recommended speed in Sigma mode
15. POOH, bleed off lubricator, lay down and rig down pulse neutron tool string

3.5 Mud Logging

3.5.1 Cuttings & Isotube/Isojar Mudgas Collection

Mud logging is completed from surface to total depth (TD) during drilling operations. 1PointFive uses the mud logging to monitor borehole gasses, confirm lithology interpretation, and select core intervals along with measure while drilling (MWD) gamma ray (GR). Cuttings and Isotubes are also collected for further analysis at the following intervals: cuttings are collected every 30 ft, Isotubes and Isojars every 60 ft and 90 ft respectively from surface to TD.

The mud logging samples are washed, dried, placed in standard envelopes, and packed in sample boxes in the proper order. The sample boxes are then identified with a label indicating operator, well name, well file number, API number, location, and depth of the samples.

<u>Dry Cutting Sample Procedure</u>

- Collect dry samples every 30 ft from surface casing to TD. Each sample shall be 30 grams.
- Photograph magnified dry samples every 30 ft measured depth (MD) from top of Anahuac to base of upper Frio (upper confining system and storage reservoir) and every 90 ft MD outside the previously mentioned interval from spud to TD with exception while coring.

<u>Wet Cutting Samples: 2 sets</u>

- Collect two mud samples at both the beginning and end of drilling or anytime the mud system is changed.
- 1st set of wet samples are collected for any optional testing if needed.
    - Collect 250 grams of unwashed wet samples every 30’ from Surface to TD.
- 2nd set of wet samples are collected for Biostratigraphy - Micropaleontology
    - Collect 250 grams of unwashed wet samples every 30’ from surface casing to TD.
- No samples taken during whole coring intervals.

<u>Isotubes and Isojars</u>

- Collect Isotubes every 60 ft from surface to TD. Isotubes are used for gas analysis.

Collect Isojars every 90 ft from surface to TD. Isojars are saved for future analysis if needed.

3.5.2 Mud Logger Requirements

- If the ROP is too high for the sampling rate, notify the Project Geologist
- Contact the Project Geologist for approval to bring an additional crew member(s) on site to help catch samples at requested rate.
- If going over the shakers or not using a bypass sluice box, it is the mud logger' s responsibility to collect samples representative of the entire sample interval.
    - I.e., suspend a sample board or bucket under the shakers to avoid collecting a spot sample.
- Gas detection and analysis equipment (gas flow lines, filters, gas trap, anti-freeze, etc) shall be checked and/or calibrated at the beginning of each shift. Chromatograph should be calibrated to pentane. This should be noted on the mud log along with mud logger' s name. Gas should be reported in parts per million.
    - New gas flow line should be laid with no splices at the start of the well.
    - If splices are needed during operations, please use an appropriate connector. Black electrical tape is not to be used to splice line together.
    - Do not leave gas flow line exposed to vehicle traffic or laid anywhere where it can be a tripping hazard.
- Do not dry cuttings with heat lamp. Air dry or use a low-heat vacuum.
- Conduct oil cut and oil show analysis for the entirety of the well, regardless of mud system, for every sample.
    - Photographs should be taken of oil shows under UV and white light in dimple dish with MD of each sample written under respective sample.
- Photographs of cuttings should be taken at every 30ft sample or as time permits, be magnified, and include a scale.
- All ditch and caving's samples shall be examined on-site and fully described on a Master Mud log at a scale of 1:100.
- Mud logs are to stay current with drilling operations.
    - Mud logger should be fully aware of where in the stratigraphic section the well is currently drilling based off estimated formation tops and markers, offset wells, and/or their own interpretation.
    - Please note any depth shifts or changes on mud log

3.5.3 Master Log Requirements

- The Master log shall include the following:

- Date of the start of each tour with mud logger' s name
- Lithology description
  - Cuttings Sample Description
    - Rock name: sandstone, silt, shale, limestone, dolomite, etc; abundance or percent in sample
    - Color
    - Hardness; fissility
    - Elements or Grains
      - Clastic: grain size, roundness, sorting
      - Carbonates: "grain" nature, "grain" size
    - Cement and Matrix
      - Clastic: abundance, nature
      - Carbonates: abundance, crystallization
    - Accessories, fossils
    - Visual porosity estimate
    - Hydrocarbon presence
      - Visual (stains and/ or bleeding)
      - Fluorescence (rate, intensity, and color)
- Hydrocarbon analysis from gas chromatograph (c1- c5, total gas). Gas track should be in parts per million.
- Cuttings gas values
- Show descriptions if present (visible oil stain, sample fluorescence, cut fluorescence, residual ring fluorescence).
- Bit runs with BHA description
- Mud properties & data (MW in/out, VIS in/out, pH, chlorides) posted every 200'
- Casing depths and descriptions
- Note: any scale changes
- Note: depth shifts or lost footage due depth recalibration
- Note: any missed sample intervals, and the reason for those missed samples on the appropriate mudlogging track.
- Drilling and/or mechanical parameters: ROP, WOB, RPM, SPM, and SPP posted every 200' on ROP track. ROP curve should be in ft/hr, black, and with amount increasing from left to right
- If available, MWD_Gamma should be displayed in the ROP track on a 0-150 API scale in green.
- Every survey data point should be reported
  - In order: MD, TVD, INC, AZM, and VS

3.5.4 Mud Logging Reporting

- Mud logger should prepare and provide a mud logging summary report via-email at least twice daily (6 a.m. and 3 p.m. Central time) to distribution.
  - This report should include:
    - Full surface to current depth LAS file
    - PDF copy of the updated mud log in 1:100 format. May be necessary to send two mud logs: one with sample pictures and one without sample pictures if file becomes too large open
    - Separate zip file containing sample pictures
- Water Based Mud with additives are expected for this well. Please check with the mud engineer or DSM for possible additives that could affect samples and/or mud log readings. Annotate as necessary
- It is the Mud logger's responsibility to make sure they have received from the Project Geologist any data (logs, mud logs, etc) which may assist them in successfully logging and analysing the well.
- Notify Project Geologist if:
  - Tripping in/ out hole
  - Open hole loggers on location, logging has commenced, logging ended, and loggers have left location
  - 500' above Coring depth intervals
  - Coring operations commences and ends
  - Any equipment failures, malfunctions, and/or deficiencies during drilling operations such as:
    - MWD/LWD gamma stops reading
    - WITS down or not reporting real time rig operations
    - Gas detection failure
    - Pump down
    - Shaker down
    - Volume increase or loss and at what depth
- All deliverables (*i.e.*, sample bags, isotubes, isojars, AGI) sent out for analysis (wet cuttings, gas or fluids) should be labelled clearly with a permanent marker including:
  - Well Name
  - API #
  - Depth range in MD
- Shipping container (buckets, rice bags) should be clearly labelled with full Well Name, API #, and depth range of samples within container.
  - Label should be clearly visible on container and written with water-resistant ink.
- All containers should include an inventory list of the cuttings within that bucket.

- Containers should be shipped in accordance with OSHA standards, and a tracking number should be provided to the Project Geologist once containers have been shipped.

3.6 Coring and SWC Sampling

The coring contractor must provide tools in good condition, with proper maintenance records, and according to the program discussed with the technical team. Operators reserve the right to inspect the tools and request a replacement if substandard conditions are detected. The coring contractor must provide the tools to cut, retrieve, and stabilize the core to get the maximum possible recovery factor. All cores or sidewall cores (SWCs) taken shall be placed in a standard core box and preserved according to the recommendation of the subject matter expert from 1PointFive.

Field procedures followed on well site. See below summary of field procedures. Additional information is detailed in the document Core Appendix.

a. Place the core cradle on the jack stand supports. **(This is where the official handoff occurs from coring company to core analysis company.)**
b. Coring company runs a GR on the core on location.
c. Core is then transferred into a liner to be epoxy stabilized.
d. The core is tagged and marked indicating the top of the core.
e. The inner barrel of the coring tool is wiped to remove drilling fluid.
f. Stabilize the core with epoxy.
g. Cut the core in 3ft sections.
h. Transfer the core sections to the RockVault, which is a temperature-controlled transportation container. Place foam inserts between each row of core sections.

Table QASP-6 shows an example of the core test program followed for the Garcias IZM 01 stratigraphic well.

Table QASP-6. Core testing program followed for Garcias IZM 01.

Core	Test	Frequency
Whole Core	[redacted]	
Whole Core, Horizontal plugs		

	[redacted]
Whole Core, Vertical plugs	[redacted]
Whole Core, Geo-mechanical	[redacted]
RSWC XL	[redacted]

3.6.1.1 Routine Core Analysis (RCA):

For information on samples preparation and procedures, please refer to the PBI_Core Procedures folder, file name PBI_Stratum_RCA.PDF . This will be the same procedure followed for whole core plugs and RSWC.

3.6.1.2 Laser Particle Size Analysis (LPSA)

For information on samples preparation and procedures, please refer to the PBI_Core Procedures folder, file name PBI_Stratum_LPSA.pdf. This will be the same procedure followed in whole core plugs and in RSWC.

3.6.1.3 Mercury Injection Capillary Pressure (MICP)

For information on samples preparation and procedures, please refer to the PBI_Core Procedures folder. File namePBI_Stratum_MICP - General Procedure.pdf. This will be the same procedure followed in whole core plugs and in RSWC.

3.6.1.4 Geological analysis: XRF, XRD, Thin sections

For information on samples preparation and procedures, refer to the PBI_Core Procedures folder, file name PBI_Stratum_GeologicalServices_XRF_XRD_ThinSections_SamplePreparationAndProcedures.pdf

3.6.1.5 Total Organic Carbon

For information on samples preparation and procedures, refer to the PBI_Core Procedures folder, file name PBI_Stratum_TOCProcedures.pdf.

3.6.2 Logging program and justification

The logging program is described in the Construction Plan document of the permit application. These activities are executed by specialized contractors with proven industry technology. Calibration and quality control of the tools will follow the service provider's protocols and procedures.

Open hole wireline logs were run in-situ to obtain stratigraphic, physical, and geo-mechanical information in both the confining and storage zones.

3.6.2.1 Open hole logging program

1. Triple combo: Gamma ray, spectral gamma ray, array resistivity, and porosity logs (density – neutron) acquired in each stratigraphic well for correlation purposes and to evaluate porosity and lithology. Basic triple combo analysis was calibrated with available core analyses.
2. Crossed Dipole HTI-F: The array sonic is run to obtain mechanical properties, and to tie with seismic and core mechanical analyses.
3. StrataXaminer (Borehole oil-based imager): Provides micro-resistivity images in a synthetic oil-based mud environment to identify structural formation dip and characterize fractures .
4. GEM – Elemental analysis tool is run as an independent lithological analysis.
5. XMR – Xaminer Magnetic Resonance is run as an independent measure of total porosity.
6. Xaminer Coring Tool is run to collect RSWC from specified core points.
7. RDT – Reservoir Description Tool is run to collect water samples and formation pressures. The RDT tool is also used to monitor a mini-frac to test formation breakdown pressure. For more details on RDT procedures please read PBI_OXY_GARCIAS_IZM-01RDT_REPORT.pdf in the petrophyscial supporting documents RDT folder.

3.6.2.2 Cased Hole logging

1. USIT and CBLTools: These tools are used to evaluate the cement to formation bond.

For additional details on data analysis, calibration and integration, see Appendix A.

The coring contractor must provide tools in good condition and according to the program discussed with the technical team. Operators reserve the right to inspect the tools and request a replacement if substandard conditions are detected. The coring contractor must provide the tools to cut, retrieve, and stabilize the core to get the maximum possible recovery factor. All cores or sidewall cores (SWC) taken shall be placed in a standard core box and preserved according to the recommendation of the 1PointFive SME.

3.7 Analysis of Injected CO_2

The CO_2 injection stream will be continuously monitored at the surface for pressure, temperature, and flow. Quarterly samples will be collected and analyzed to track CO_2 composition and purity. Table QASP-7 below shows the list of constituents to be analyzed, based on the anticipated composition of the CO_2 stream.

Table QASP-7: CO_2 Stream Analysis

Constituent	Frequency
Pressure	Continuous
Temperature	Continuous
Rate	Continuous
CO_2 (% mol)	Quarterly
[redacted]	

3.8 Sampling and Custody

CO_2 sampling will be performed upstream or downstream of the flowmeter. Sampling procedures, including where the sampling will be performed, will be further refined during FEED and will follow contractor protocols to ensure the sample is representative of the injectant. Samples will be processed, packaged, and shipped to the contracted laboratory, following standard sample handling and chain-of-custody guidance (EPA 540-R-09-03, or equivalent). Sample tubing, connectors, and valves required to sample the CO_2 gas stream will be supplied by the analytical lab providing the sampling containers. Once the samples are analyzed, the laboratory will be responsible for disposing of the containers and residues properly and in accordance with applicable regulations.

3.9 Equipment and Calibration

Sampling equipment in the field will be maintained, serviced, and calibrated per the manufacturer's recommendations. Spare parts that may be needed will be included in the supplies on hand during field sampling. Laboratory equipment supply, testing, calibration, inspection, and maintenance will be the responsibility of the analytical laboratory per its protocols and Quality Assurance (QA) program. 1PointFive reserves the right to review and audit the protocols and methods of the selected laboratory before awarding the work.

3.10 Personnel and Training

During initial operations, sampling will be performed by trained personnel from the laboratory. In addition, field staff will be trained in the procedures and protocols to take the samples.

4.0 Analytical Methods

4.1 CO_2 Sampling

The operating temperature for the gas chromatography (GC) analytical method is from –10°C to 50°C. Also, relative humidity should be 95% or less to avoid condensation. The detection limits for various components can be found in Table QASP-8.

Table QASP-8: Sampling Methods Summary

Analytical Parameter	Analytical Method	Detection Limit	Typical Precision/Accuracy
[redacted]			

[redacted]

Notes:

- GC/TCD = gas chromatography with a thermal conductivity detector
- GC/FDP = gas chromatography with flame photometric detector
- GC/HID = gas chromatography with helium ionization detector
- GC/FID = gas chromatography with flame ionization detector
- Oxygen and Argon are reported together

CO_2 samples will be also analyzed during the baseline period to identify isotopes (See Table Q9).

***Table QASP-9:* Isotopes Sampled for Identification**

Hydrocarbons	Method
[redacted]	

Notes:

- GC-IRMS = Gas chromatography isotope ratio mass spectrometry
- AMS = Accelerator mass spectrometry

Gas samples will be analyzed by a third-party laboratory, which will be responsible for updating protocols and providing a quality control protocol.

If the CO_2 composition shows abnormal values during the testing period, a validation of the sampling process will be performed with a new sample collected by the laboratory technician and sent to the testing facilities for verification.

4.2 Corrosion Coupons

Injection well material samples, called coupons, will be monitored for signs of corrosion to verify that the well components meet the standards for material strength and performance, as well as to identify well maintenance needs. The coupons shall be collected and sent quarterly to a third-party company for analysis, conducted in accordance with NACE Standard SP-0775-2018-SG, to determine and document corrosion wear rates based on mass loss.

4.2.1 Sampling and custody

The following information must be recorded prior to coupon installation: coupon serial number, installation date, system location identification number (linked to SAP asset numbering), and coupon and holder orientation. The coupon should also be handled carefully to avoid contamination.

The field operator will collect the coupons and identify them by the serial number, date, company name, location identification number, and field operator name. The operator in the field will visually inspect the coupon for signs of erosion, pitting, scale, or other damage, and will take a picture before packing the sample. The coupon will be protected from oxidation and handling contamination by placing the coupon in a designated, moisture-proof envelope that is impregnated with a volatile corrosion inhibitor and shipped immediately to the laboratory for analysis.

As part of the training program, the field operator will be trained in best practices to mitigate coupon contamination.

4.2.2 Equipment calibration

Preparation, cleaning, and evaluation of corrosion specimens will be handled by a certified third-party contractor following NACE RP0775-2005 or its equivalent. The contractor is responsible for the calibration and maintenance of the measurement equipment as well as the disposal of the samples when the analysis is finished.

Table QASP-10—Analytical Methods

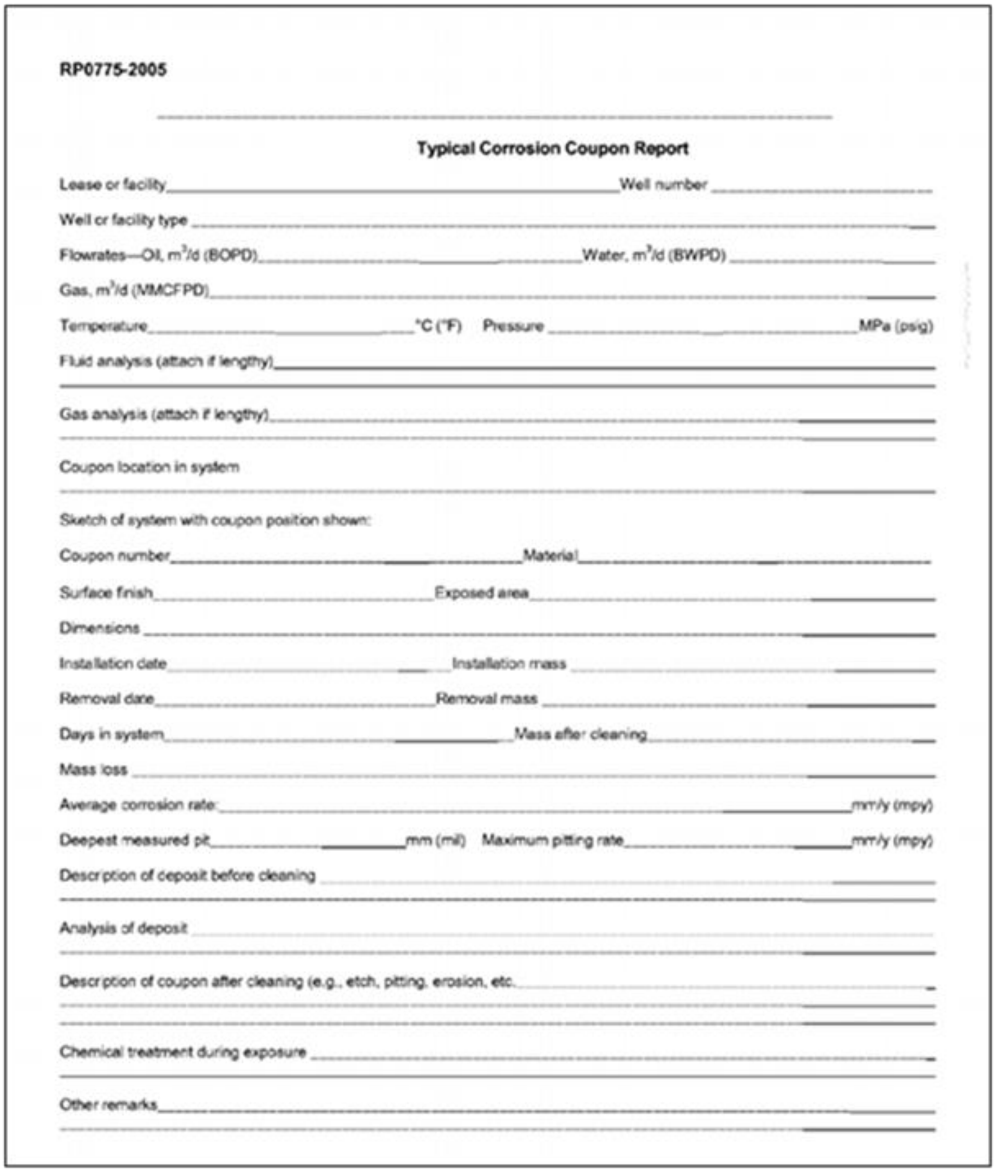
Parameters	Analytical Method	Resolution Instruments	Precisions/Std Dev
[redacted]			

Notes:

- [redacted]

4.2.3 Quality Control

1PointFive reserves the right to audit the QA/QC procedures before awarding the work to a contractor and during the execution of the service.



RP0775-2005

Typical Corrosion Coupon Report

Lease or facility ______ Well number ______

Well or facility type ______

Flowrates—Oil, m^3/d (BOPD) ______ Water, m^3/d (BWPD) ______

Gas, m^3/d (MMCFPD) ______

Temperature ______ °C (°F) Pressure ______ MPa (psig)

Fluid analysis (attach if lengthy) ______

Gas analysis (attach if lengthy) ______

Coupon location in system ______

Sketch of system with coupon position shown:

Coupon number ______ Material ______

Surface finish ______ Exposed area ______

Dimensions ______

Installation date ______ Installation mass ______

Removal date ______ Removal mass ______

Days in system ______ Mass after cleaning ______

Mass loss ______

Average corrosion rate ______ mm/y (mpy)

Deepest measured pit ______ mm (mil) Maximum pitting rate ______ mm/y (mpy)

Description of deposit before cleaning ______

Analysis of deposit ______

Description of coupon after cleaning (e.g., etch, pitting, erosion, etc. ______

Chemical treatment during exposure ______

Other remarks ______

Figure QASP-1—Sample Corrosion Coupon Report

4.3 Soil Gas Sampling

The method for soil gas sampling is described in Section 7 of the Testing and Monitoring Plan. The samples will be sent to q specialized laboratory to determine gas composition and perform isotopic analysis to characterize the fluid and get a fingerprint for appropriation.

4.3.1 Analytical Method

Compositional analysis of the gases includes chromatographic determination of the concentrations of fixed gases and hydrocarbons listed in Table QASP-11.

Table QASP-11—Soil Gas Analysis Parameters

Soil Gas Parameter	Analysis method	Detection Limit	Typical Precision/Accuracy
[redacted]			

Notes:

- GC = Gas Chromatography
- IRMS = Isotope Ratio Mass Spectrometry
- AMS = Accelerator Mass Spectrometry

Isotopes are different forms of the same element, differing only in the number of neutrons in the nucleus of the atom. Although some isotopes are unstable and decay radioactively, most are stable. Isotopes are a valuable tool for distinguishing the source of the element and creating a fingerprint of the gas.

4.3.2 Equipment Calibration

Calibration will be performed by manufacturer using their protocol. Sampling will be performed by trained or specialized personnel from the lab at the beginning of the operation, and the field operator will be trained in the process to take samples and monitor gas composition with handheld devices as a part of routine operations.

5.0 Water Sampling

The following methodology will be used to collect ground water samples:

- Purge the well to remove standing and/or stagnant water from the well casing. The purpose of purging is also to reduce chemical and biochemical artifacts caused by the materials used for well installation and construction and reactions occurring within an open borehole or annular space between a well casing and borehole wall.
- At a minimum, purge [redacted] well casing volumes while monitoring the temperature, pH, and conductivity until the readings have stabilized.
- Record the well diameter, water level, well bottom depth, and purge volume on the field data sheet.
- If the readings have stabilized after purging with [redacted] well volumes and meet the criteria in Table QASP-11 then proceed with sample collection.
- If readings have not stabilized after [redacted] well volumes, continue to purge until they are stable, but do not exceed ten purge volumes before collecting samples.
- Document those instances when the readings were not stable prior to sample collection.
- The measurement stability criteria in Table QASP-112 show the allowable variations among five or more field measurements.

Table QASP-12—Field Measurement Stability Criteria

Field Measurement	Stability Criteria
pH	± 0.1 standards units
Temperature, °C	± 0.5°C
Conductivity, µS/cm	± 5%

5.1 Equipment and Calibration

For groundwater sampling, field equipment will be maintained, serviced, and calibrated according to the manufacturers' recommendations. Spare parts that may be needed will be included in supplies on hand during field sampling. All laboratory equipment, testing, inspection, maintenance, and calibration will be the responsibility of the analytical laboratory according to method-specific protocols and the laboratory's QA program.

5.2 Personnel and Training

Water testing will be performed by certified laboratory personnel following the specific methods approved by the EPA or other applicable industry standard. A 1PointFive operator may audit the procedures and results of the selected laboratory to improve quality control. Field personnel should be trained to perform sampling collection following the laboratory's protocols.

5.3 Analytical Method

Where possible, methods are based on standard protocols from the EPA or industry standard methods for water analysis. Laboratories shall have standard operating procedures for the analytical methods performed.

Table QASP-13—Analytical Method Selected for Various Parameters

Parameter	Analytical Method	Detection Limit	Typical Precision/Accuracy
[redacted]			

[redacted]

ICP-OES = inductively coupled plasma optic emission spectrometry; ICP-MS = inductively coupled plasma mass spectrometry; GC/MS = gas chromatography–mass spectrometry; ; AMS = accelerator mass spectrometry; CRDS = cavity ring down spectrometry; IRMS = isotope ratio mass spectrometry; CVAA: Cold Vapor Atomic Absorption;

Note: Isotopes will be analyzed only during the pre-injection baseline, and if required for appropriation based on other monitoring results.

5.4 Quality Control

Quality control of the sampling and results will follow the protocols established in the standard analytical method used for testing (See Table QASP-13). 1PointFive reserves the right to audit the laboratory procedures and protocols to validate that the methods are being followed and results are accurate.

6.0 Continuous Recording of Injection Parameters

Injection pressure and temperature (P/T) will be measured continuously in each injection well at the surface via real-time P/T instruments installed in the CO2 flowline near the interface with the wellhead. The flow rate of CO2 injected into the wellhead will be measured by flow meter skids with a coriolis meters. Automated shut off devices will be used to stop injection if injection parameters deviate outside established operational limits and in accordance with the ERRP.

Table QASP-14: Technical Specification for Surface Pressure Transducers

Surface Pressure Transducer Specifications
[redacted]

Table QASP-15: Technical Specification for Surface Temperature Transducer

Surface Temperature Transducer Specifications
[redacted]

Pressure and temperature gauges will be deployed on the tubing above and below the injection packer to monitor bottomhole conditions in real time. The gauges and cables will be selected to withstand CO2 service conditions, and the data will be integrated into the SCADA system and surveillance platform. Table QASP-16 shows an example of the technical specifications for downhole gauges.

Table QASP-16: Technical Specifications for Downhole P/T Sensors

Downhole P/T Sensor Specifications
[redacted]

[redacted]

The flow rate of CO_2 injected into the well will be measured by flow meter skids with a coriolis type flow meter. Table QASP-17 is an example of typical meter specifications.

Table QASP-17: Example of Coriolis Meter Specifications

Parameter	Specification
[redacted]	

Automated shutdown valves will be used to stop the flow of CO2 to the well in the event that operation parameters deviate from established operational limits and in accordance with the ERRP. The valves are currently planned as ASME [redacted], but will be confirmed during detailed engineering of the surface facilities.

7.0 Injection Well – Well Testing

7.1 Step Rate Test

A Step Rate (SRT) test is normally used to estimate fracture pressure (formation parting pressure) in an injection well for a given geologic formation. The test is conducted by injecting fluid into the formation at a series of increasing rates, allowing each rate to stabilize, and noting the stabilized injection pressure for each rate. A plot of injection pressure versus injection rate is then made to identify the fracture pressure.

Equipment

The basic equipment required is as follows:

- A water supply truck capable of pumping the water down hole under increasing pressures.
- Surface monitoring equipment capable of measuring injection rate and pressure.
- Enough storage and volume of the water and additives to avoid interruption of the test.
- Bottom-hole pressure memory gauge or permanent pressure gauges installed in the well during original completions. It is recommended to use redundant pressure gauges during the test with one gauge serving as a backup, or for verification in cases of questionable data quality.

To convert surface pressure to bottom-hole pressure (BHP), the inside diameter and condition of the tubing must be known to compute frictional losses, and the density of the injected fluid must be known to compute the hydrostatic pressure. A bottom-hole pressure gauge should be used to measure BHP to provide two sources of pressure data for comparison.

Procedure:

The following SRT procedure is recommended:

The test well should be shut-in long enough, but not less than [redacted] hours so that the BHP is near the shut-in formation pressure. The SRT should start at a suitably low rate such that at least two injection rate steps are below the formation fracture pressure and at least three rates are above the formation fracture pressure. A plot of the injection rate versus surface pressure and BHP will facilitate the determination of the formation fracture pressure. The point at which the slope of the lower fracture rates intersects the slope of the higher fracture rates is the formation fracture pressure, which can be expressed as a fracture gradient (psi/ft.).

It's recommended that injection rate step is stable before proceeding to the next higher rate. [redacted]. Each step should last exactly as long as the preceding step. Surface pressure and BHP measurements should be recorded at shut-in (instantaneous shut-in pressure, ISIP), after 5 minutes of shut-in, and after 10 minutes of shut in.

It is recommended to use redundant pressure gauges during the test with one or more gauges serving as a backup, or for verification in cases of questionable data quality.

Analysis:

The analysis consists of plotting injection pressure at the end of each rate vs. injection rate. It is preferable to plot bottom-hole pressure, but surface pressure may be used if it is positive throughout the test and the friction effects are not significant. The plot should have two straight lines segments, as illustrated in the Figure QASP -2.

Figure QASP-2: Step Rate Test Data Plot Example

7.2 Injectivity Test

The injectivity test is pressure transient testing during injection into a well. It is analogous to drawdown testing, for both constant and variable rates. This test and the analysis apply to liquid filled reservoirs with the mobility of the injected fluid similar or equal to the mobility of the in-situ fluid (Robert Earlougher, 1997).

The test will be performed after the tubing and packer are installed in the CO2 injector well and will be performed with water and clay inhibitors if required to avoid formation damage. Before the injectivity test, a Step Rate Test (SRT) will be conducted to validate fracture pressure values and identify the optimum injection rates. After the injectivity test is performed the well will be shut in to proceed with the Fall Off test.

The basic equipment required is as follows:

- A water supply truck capable of pumping the water down hole under increasing pressures.
- Enough storage and volume of the water and additives to avoid interruption of the test.
- Surface monitoring equipment capable of measuring injection rate and pressure.
- Bottom-hole pressure memory gauge or permanent pressure gauges installed in the well during original completions. It is recommended to use redundant pressure gauges during the test with one gauge serving as a backup, or for verification in cases of questionable data quality.

Procedure:

- The well is initially shut in and pressure is stabilized at the initial reservoir pressure, pi.
- Measure initial reservoir pressure in surface as well as downhole with the permanent gauges installed in the completion.
- At time zero, injection starts at a constant rate establish after the SRT is performed. The selected rate should be high enough to cause a pressure which is equal to the depth of the top of the tested zone times the 90% of the fracture gradient value identified during the SRT.
- Continue injection until pressure measurement become near stable unless this is impossible due to slow increase or high injection pressures. If pressure is stable injected enough fluid to reach modeled conditions to start the fall off test.
- Its advisable to monitor the injection rate carefully to adjust the interpretation in case the rate varies significantly.
- Shut in the well and start the fall off test.

7.3 Fall Off Test

A Fall Off test is a pressure transient test that consists of shutting in an injection well and measuring the pressure falloff. The falloff period is a replay of the injection preceding it; consequently, it is impacted by the magnitude, length, and rate fluctuations of the injection period. Falloff testing analysis provides transmissibility, skin factor, and well flowing and static pressures.

The basic equipment required is as follows:

- Pumping system (trucks or surface pump) and enough amount of the injectant to ensure an adequate test.
- Surface monitoring equipment capable of measuring injection rate and pressure.
- Bottom-hole pressure memory gauge or permanent pressure gauges installed in the well during original completions. It is recommended to use redundant pressure gauges during the test with one gauge serving as a backup, or for verification in cases of questionable data quality.

General considerations:

- Adequate volume of the injectant should be ensured for the duration of the test.
- The radial flow portion of the test is the basis for all pressure transient calculations. Therefore, the injectivity and falloff portions of the test should be designed not only to reach radial flow, but to sustain a time frame sufficient for analysis of the radial flow period.
- Offset wells completed in the same formation as the test well should be shut-in, or at a minimum, provisions should be made to maintain a constant injection rate prior to and during the test.
- The location of the shut-in valve on the well should be at or near the wellhead to minimize the wellbore storage period.
- The condition of the well, junk in the hole, wellbore fill, or the degree of wellbore damage (as measured by skin) may impact the length of time the well must be shut-in for a valid falloff test. This is especially critical for wells completed in relatively low transmissibility reservoirs or wells that have large skin factors.
- Cleaning out the well and acidizing may reduce the wellbore storage period and therefore the shut-in time of the well.
- Accurate recordkeeping of injection rates is critical including a mechanism to synchronize times reported for injection rate and pressure data. Time synchronization of the data is especially critical when the analysis includes the consideration of injection from more than one well.
- If more than one well is completed into the same reservoir, operators are encouraged to send at least two pulses to the test well by way of rate changes in the offset well following the falloff test. These pulses will demonstrate communication between the wells and, if maintained for sufficient duration, they can be analyzed as an interference test to obtain interwell reservoir parameters.

Site Specific Pretest Planning:

1. Tag and record the depth to any fill in the test well.

2. Simplify the pressure transients in the reservoir.

- Maintain a constant injection rate in the test well prior to shut-in. This injection rate should be high enough and maintained for a sufficient duration to produce a measurable pressure transient that will result in a valid falloff test.
- Offset wells should be shut-in prior to and during the test. If shut-in is not feasible, a constant injection rate should be recorded and maintained during the test and then accounted for in the analysis.
- Do not shut-in two wells simultaneously or change the rate in an offset well during the test.

3. The test well should be shut-in at the wellhead to minimize wellbore storage and afterflow.
4. Maintain accurate rate records for the test well and any offset wells completed in the same injection interval.
5. Measure and record the viscosity of the injectate periodically during the injectivity portion of the test to confirm the consistency of the test fluid.

Evaluation of the Fall Off Test:

1. Prepare a Cartesian plot of the pressure and temperature versus real time or elapsed time.

- Confirm pressure stabilization prior to shut-in of the test well.
- Look for anomalous data, pressure drop at the end of the test, determine if pressure drop is within the gauge resolution.

2. Prepare a log-log diagnostic plot of the pressure and semi log derivative. Identify the flow regimes present in the well test.

- Use the appropriate time function depending on the length of the injection period and variation in the injection rate preceding the falloff.
- Mark the various flow regimes - particularly the radial flow period.
- Include the derivative of other plots, if appropriate (e.g., square root of time for linear flow)
- If there is no radial flow period, attempt to type curve match the data.

3. Prepare a semilog plot.

- Use the appropriate time function depending on the length of injection period and injection rate preceding the falloff.
- Draw the semilog straight line through the radial flow portion of the plot and obtain the slope of the line.

- Calculate the transmissibility, kh.
- Calculate the skin factor, s, and skin pressure drop, DPskin.
- Calculate the radius of investigation, ri.

4. Explain any anomalous results.

8.0 Distributed Temperature Sensing (DTS)

Distributed Temperature Sensing (DTS) uses fiber optic sensor cables, typically several kilometers in length, that function as linear temperature sensors. The result is a continuous temperature profile along the entire length of the well. DTS specifications are shown below in Table QASP-18.

Table QASP-187: DTS Technical Specifications

Parameter	Value
[redacted]	

Table QASP-19: Fiber Optic Cable Technical Specifications

Parameter	Value
[redacted]	

[redacted]

9.0 Leak Detection

9.1 Optical Gas Imaging Camera (OGI)

OGI cameras use unique spectral filters to detect gas compounds. The filter restricts the wavelengths of radiation allowed to pass through the detector to a very narrow band called band pass. OGI cameras will be used to identify fugitive emissions or other leaks of specified constituents from surface facilities, pipelines, wells, and other equipment at the Project.

Table QASP-20: FLIR Optical Gas Imaging Camera Specifications

Model	GF343
Detector Type	Focal plane array, cooled InSb
Spectral Range	4.2 – 4.4 µm
Resolution	320 x 240 pixels
Detector Pitch	30 µm
NETD/Thermal Sensitivity	< 15 mK @ +30°C (+86°F)
Sensor Cooling	Stirling Microcooler (FLIR MC-3)
Electronics / Imaging	
Image Modes	IR image, visual image, High Sensitivity Mode (HSM)
Frame Rate (Full Window)	60 Hz
Dynamic Range	14-bit
Video Recording / Streaming	Real-time non-radiometric recording: MPEG4/H.264 (up to 60 min./clip) to memory card Real-time non-radiometric streaming: RTP/MPEG4
Visual Video	MPEG4 (25 min./clip) to memory card
Visual Image	3.2 MP from integrated visible camera
GPS	Location data stored with every image
Camera Control	Remote camera control via USB
File Storage	
Storage Media	Removable SD or SDHC memory card; two card slots
Image Storage Capacity	> 1200 images (JPEG) with post-process capability per GB on memory card
Optics	
Camera f/number	f/1.5
Available Fixed Lenses	14.5° (38 mm), 24° (23 mm)
Focus	Automatic (one touch) or manual (electric or on the lens)
Image Presentation	
On-Camera Display	Built-in widescreen, 4.3 in. LCD, 800 x 480 pixels
Automatic Gain Control	Continuous/manual, linear, histogram
Menu Commands	Level/span, auto adjust continuous/manual/semi-automatic, zoom, palette, start/stop recording, store image, playback/recall image
Color palettes	Iron, Gray, Rainbow, Arctic, Lava, Rainbow HC
Zoom	1-8x continuous, digital zoom
General	
Operating Temperature Range	–20°C to +50°C (–4°F to +122°F)
Storage Temperature Range	–30°C to +60°C (–22°F to +140°F)
Encapsulation	IP 54 (IEC 60529)
Bump / Vibration	25 g (IEC 60068-2-27) / 2 g (IEC 60068-2-6)
Power	AC adapter 90-260 VAC, 50/60 Hz or 12 V from a vehicle
Battery System	Rechargeable Li-ion battery
Weight w/ Battery & Lens	2.48 kg (5.47 lb.)
Size (L x W x H) w/ Lens	306 × 169 × 161 mm (12.0 × 6.7 × 6.3 in.)
Mounting	Standard, 1/4”-20

9.2 Wellhead Atmospheric CO_2 Sensor Wellheads

1PointFive will install infrared gas detectors close to the wellheads of the injector and monitoring wells. These sensors will interface with the surveillance system to set alarms and provide information on potential leaks at the surface.

Table QASP 21: Wellhead Atmospheric CO_2 Sensor Specifications (Example)

Parameter	Specification
[redacted]	

10 Induced Seismicity Tracking

1PointFive will deploy a seismometer monitoring network to determine the locations, magnitudes, and focal mechanisms of seismic events (if any).

10.1 Geophone Array for Seismicity

Based on the information provided by United States Geological Survey (USGS), the selected area does not show high seismic activity that could endanger the containment of the CO_2 in the storage complex or nearby infrastructure. Seismicity history is discussed in more detail in the Area of Review and Corrective Action Plan document of the permit.

Change of in-situ stresses on existing faults caused by human activities (*e.g.*, mining, dam impoundment, geothermal reservoir stimulation, wastewater injection, hydraulic fracturing, and CO_2 sequestration) may induce earthquakes on critically stressed fault segments. To monitor potentially induced seismicity due to the injection of CO_2 in the area, it is proposed that the project deploy surface seismometer stations. While the historical seismicity of the project area indicates no earthquakes in the immediate vicinity, the operator intends to monitor both the storage facility and adjacent infrastructure with a seismic monitoring system for the duration of the Project. The seismic monitoring will be conducted with a surface array deployed to detect events above $M_L1.0$, with epicentral locations within 10 miles of any injection well.

If an event is recorded by either the local private array or a public (national or state) array to have occurred within 5.6 miles of an injection well, the operator will implement its response plan subject to detected earthquake magnitude limits defined in the ERRP.***10.1.1 Personnel***

The design and installation of the station array is performed by specialized contractors and includes the following activities:

- Project management support to design the seismometer array, model the network performance, coordinate permitting and equipment installation, conduct testing and maintenance, and ensure optimum execution of the project;
- Field operations to deploy seismic station instrumentation, run power and communication systems, monitor data quality, and do commissioning;
- Data acquisition, system configuration, and process setup;
- Continuous support and monitoring for data verification and QA/QC; and
- Continuous near-real-time reporting, including analyst reviews and alert notifications, for events at or above predetermined magnitude thresholds over the seismic area

10.1.2 Equipment

The equipment proposed for seismic station includes:

- Broadband sensors
- Data logger
- Solar power system and backup battery
- Communication system
- Cabling
- Mounting equipment

Figure QASP-3 shows the technical specifications for broadband seismometer as a reference.

Figure QASP-4 shows an example of a setup for data acquisition, transfer, storage, and analysis.

TECHNICAL SPECIFICATIONS TRILLIUM COMPACT PH

Specifications subject to change without notice

TECHNOLOGY

Topology: Symmetric triaxial
Feedback: Force balance with capacitive transducer
Mass Centering: Not required

SEISMOMETER MODULE PERFORMANCE

Self-noise: See self-noise graph
Nominal Sensitivity: 750 V·s/m (reference User Guide for precise value)
Precision: ±0.5% relative to User Guide specification
Bandwidth/120s: -3 dB points at 120 s and 108 Hz
Bandwidth/20s: -3 dB points at 20 s and 108 Hz
Off-axis Sensitivity: ±0.5%
Clip level: 26 mm/s up to 10 Hz and 0.17 *g* above 10 Hz
Oper. Tilt Range/120s: ±2.5°
Oper. Tilt Range/20s: ±10°
Parasitic Resonances: None below 200 Hz
Dynamic Range/120s: > 159 dB @ 1 Hz
Dynamic Range/20s: > 152 dB @ 1 Hz

LEVELING AND ALIGNMENT

Digital bubble level: Graphical bullseye level is available via Centaur digital recorder GUI
Physical Bubble level: Optional accessory
Alignment: Vertical scribe marks for (N and S); precision guide in cover for straight-edge, line, or laser level

INTERFACE

Connector: 16-pin, marine SubConn MCBH16MSS, top-mounted

Velocity Output: 40 V peak-to-peak differential
- Selectable XYZ or UVW mode

Mass Position Output: Single ±4 V output representing maximum mass position
- 3-channel mass positions available through serial port

Calibration Input: Single voltage input and one active high control signal to enable all 3 channels
- Remote calibration in XYZ or UVW mode
- Independent channel selection by serial port

Control Lines: Cal. Enable or Long/Short Period mode, XYZ/UVW mode

Serial Port: RS-232 compatible serial IP (SLIP)
- Onboard web server standard HTTP
- For enhanced instrument control and status: UVW/XYZ mode, short/long period mode, firmware updates, temperature, mass position, case tilt, digital bubble level, serial number and factory info

POWER

Supply Voltage: 9 to 36 VDC isolated input
Power Consumption:
- 180 mW typical (model TC120-PH2)
- 195 mW typical (model TC20-PH2)

Protection: Reverse-voltage and over-voltage protected
- Self-resetting over-current protection

PHYSICAL

Diameter: 97 mm
Height:
- Body & connector: 160 mm
- On fixed studs: 167 mm

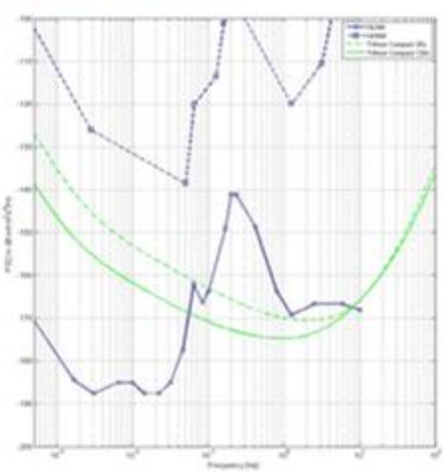
Weight/120s: 3.2 kg
Weight/20s: 3.2 kg
Housing: Stainless steel, resistant to corrosion, scratches & chips

ENVIRONMENT

Operating temperature:
-20°C to 60°C (Standard Model)
-50°C to 60°C (Polar Certified Model)
Storage temperature: -40°C to 70°C
Shock:
- 100 *g* half sine, 5 ms without damage, 6 axes
- No mass lock required for transport

Magnetic: Insensitive to natural variations of the earth's magnetic field
Ingress Protection: Rated to IP68 to 300 m for prolonged immersion

SELF-NOISE PERFORMANCE PLOT



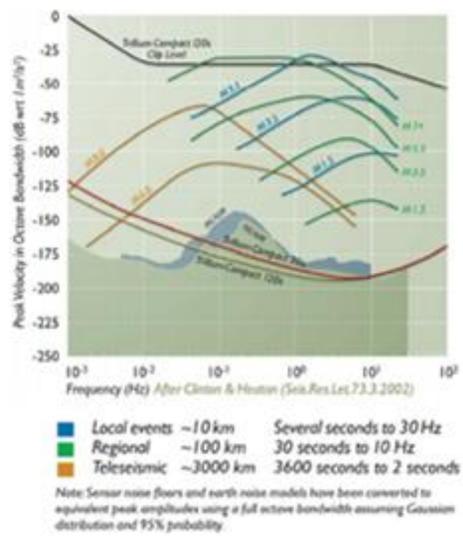


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Figure QASP-3: **Technical Specification for a Broadband Seismometer**

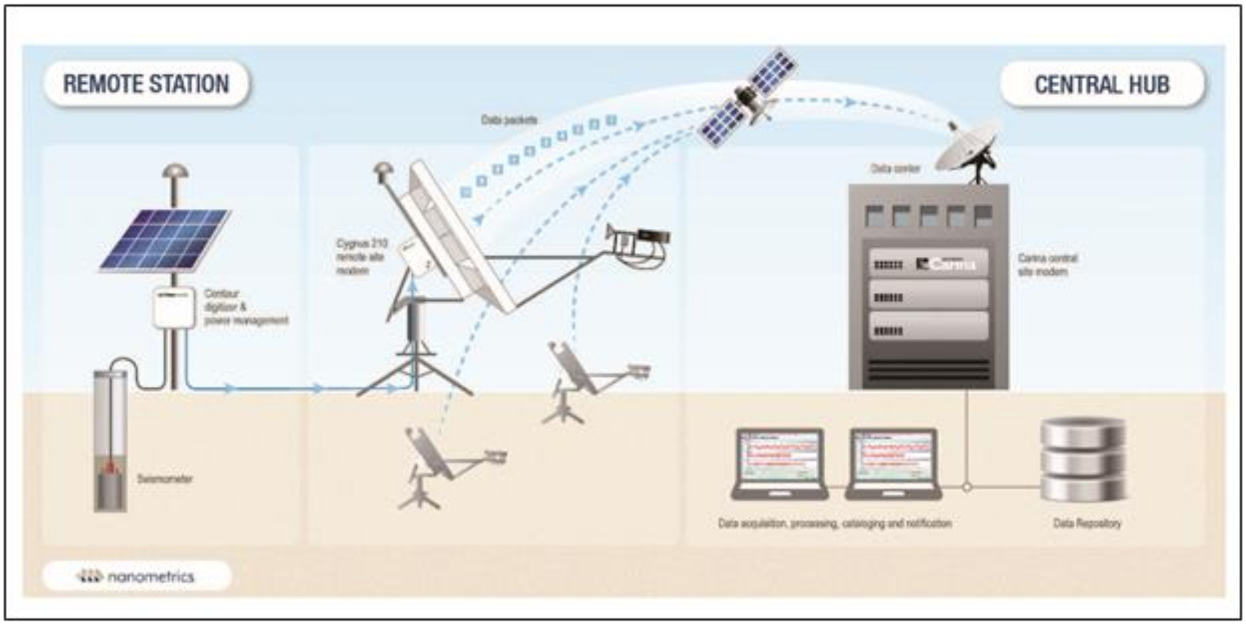

Figure QASP-4— Data Acquisition Setup Example

11.0 References

11.1 EPA Region 6 Falloff Guidelines

11.2 SPE Monograph 5, "Advances in Well Test Analysis," 1977, Robert Earlougher, Jr.