Bluebonnet Sequestration Hub

QUALITY ASSURANCE AND SURVEILLANCE PLAN
40 CFR §146.90(k)

1.0 Facility Information

Facility name: Bluebonnet Sequestration Hub (Bluebonnet Hub or the Project)
Bluebonnet CCS 1, Bluebonnet CCS 2, and Bluebonnet CCS 3 Wells.

Facility contacts: Claimed as PBI [redacted]

Well location: Chambers, Texas

Well Name	Latitude (NAD27)	Longitude (NAD27)
Bluebonnet CCS 1	Claimed as PBI [redacted]	[redacted]
Bluebonnet CCS 2	Claimed as PBI [redacted]	[redacted]
Bluebonnet CCS 3	Claimed as PBI [redacted]	[redacted]

2.0 Project Management and Surveillance Process

The Bluebonnet Sequestration Hub is supported by multidisciplinary teams from the Bluebonnet Sequestration Hub, LLC, consultants, subcontractors, and government entities. Each team will provide technical expertise and economic input into the project to ensure a safe, successful, and efficient operation.

The reservoirs, seals, and subsurface features have been characterized by experienced geoscience professionals using industry-recognized simulation software and techniques. Further characterization of the features will be done using the latest logging and testing technologies as the wells are being drilled.

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 the site to ensure protection of the underground sources of drinking water (USDW) 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 worldwide as well as Occidental's (Oxy's) 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 operations staff. For specialized data such as seismicity Claimed as PBI [redacted] 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 unique 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 Area of Review (AoR) reviews, quality assurance programs, and reporting.

The project will establish key staffing positions for reliable operation, 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, Bluebonnet Sequestration Hub, LLC, 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, LLC (OLCV), the parent company of Bluebonnet Sequestration Hub, LLC, 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:** This director plays a critical role in the subsurface activities regarding the CO_2 sequestration site, including geological and reservoir modeling, petrophysics, and geophysics. This director is responsible for analyzing the site and ensuring subsurface safety based on various modeling assumptions regarding carbon capture and storage.

- **Director Operations and Technical Support:** This director plays a central role in implementing all data gathering and analysis for the CO_2 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 to provide sources of CO_2 for sequestration. This individual negotiates contracts with the various parties and identifies the financial terms. 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 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 those plans, 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 the injection and various monitoring wells, including obtaining budget pricing information, designing the wellbores, drilling the wells, and developing the monitoring programs for the wells involved. One additional responsibility is reviewing the wellbores 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 for use in the subsurface model of the area.

- **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 (subcontractor) geologists, hydrologists, chemists, atmospheric scientists, ecologists, etc. These SMEs help develop testing and monitoring plans, collect environmental data specified in those plans using best practices, and maintain and update those plans as needed.

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 will be analyzed, processed, or witnessed by third parties independently and outside of the project management structure.

2.1.3 QA Project Plan Responsibility

The Bluebonnet Sequestration Hub, LLC, 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 serve as a quality control mechanism. Issues identified during a peer review will be addressed and corrected by the data owner. Errors identified in the data via validation 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 Bluebonnet Hub must provide a copy of their quality assurance/quality control (QA/QC) and safety management program to qualify for performing the work. The contractors may be audited by the Bluebonnet Sequestration Hub, LLC, SMEs, and safety representatives. All contractors are required to comply with the Worker Safety Program and Operations policies at the work site. The Bluebonnet Sequestration Hub, LLC, reserves the right to inspect and audit the contractor's operation and quality program to guarantee the safety and quality programs are being followed.

2.5 Special Training and Certificates

Wireline logging, indirect geophysical methods, and nonroutine sampling will be performed by trained, qualified, and certified personnel, according to the service company's requirements.

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 logging processing and 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 Underground Injection Control (UIC) requirements.

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.

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 testing and monitoring plan proposes using cement bond logs (CBL) and variable density logs (VDL). Table QASP-1 provides the basic data for some of the tools in the market.

3.1.1 Tool Specifications

Table QASP-1: Cement bond logging and variable density log specifications (CBL/VDL).

Claimed as PBI [redacted]

These activities will be 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 Claimed as PBI [redacted]

[redacted].

3. Claimed as PBI [redacted]

3.2 Electromagnetic and Ultrasonic Cement and Casing Evaluation Tools

For mechanical integrity evaluation, the Testing and Monitoring Plan and the Pre-Operational Formation Testing Plan propose using ultrasonic and electromagnetic tools to evaluate the conditions of the tubulars in the well and provide information about thickness, ovality, ruptures, potential corrosion, etc. Table QASP-2 provides the basic data for some of the proposed tools available in the market.

3.2.1 Tool Specifications

Table QASP-2: Tool data sheet summary for magnetic, sonic and ultrasonic tools.

Claimed as PBI [redacted]

Claimed as PBI [redacted]

These activities will be 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 Claimed as PBI [redacted]

[redacted] Claimed as PBI

3.3 Temperature Log

To help locate gas entries, detect casing leaks, and evaluate fluid movement behind the casing in the monitoring wells, the Testing and Monitoring Plan proposes using temperature logs as a potential method. Table QASP-3 provides example of basic tool specification.

3.3.1 Tool Specifications

Table QASP-3: Halliburton BHPT-I (temperature) specifications.

Claimed as PBI [redacted]

These activities will be 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 Claimed as PBI [redacted]

[redacted]

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-4 shows the basic specification of some of the tools in the market.

3.4.1 Tool Specifications

Table QASP-4: Basic tool specifications for pulse neutron.

Claimed as PBI [redacted]

These activities will be 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 Claimed as PBI [redacted]

[redacted]

8. Claimed as PBI [redacted]

3.5 Mud Logging

Mud logging samples will be collected during drilling from the surface to final total depth (TD). Descriptions of the cuttings, Measure while Drilling / Logging While Drilling (MWD/LWD) gamma, and real-time drilling observations will be used to help call formation tops, influence rate of penetration (ROP) before core runs, and call or adjust core depths. Post-drill: cuttings and mud log documents will be used to further describe the subsurface.

3.5.1 Cuttings & IsoTube/Isojar Mudgas Collection

- Dry Cutting Samples
  - Collect unwashed, dry samples (30 grams) every 30 ft from the surface to TD.
- Wet Cutting Samples
  - Collect unwashed, wet samples (250 grams) every 30 ft from the surface to TD.
- Spare Cutting Samples
  - Collect washed, dry samples (30 grams) every 30 ft from the surface to TD (~10,900 ft).
  - Photograph magnified dry samples every 30 ft from the top of Anahuac to the base of the upper Frio (upper confining system and storage reservoir) and every 90 ft outside the previously mentioned interval from spud to TD except while coring.
  - Dispose of spare cutting samples on shakers after use.
- IsoTube/Isojar Mud Gas Collection
  - Collect mud gas samples from the provided manifold within each predetermined depth interval.

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 the 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.
- Gas detection and analysis equipment (gas flow lines, filters, gas trap, antifreeze, etc.) shall be checked and/or calibrated at the beginning of each shift. The 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 (ppm).
- Do not dry cuttings with a 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 a dimple dish with the MD of each sample written under the respective sample.
- Photographs of cuttings should be taken of every 30-ft sample or as time permits, be magnified, and include a scale.
- All ditch and caving samples shall be examined on site and fully described on a Master Mud log at a scale of 1:100.

3.5.3 Mud Logging Reporting

- 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 number, and depth range in measured depth.
- Shipping containers (e.g., buckets, rice bags) should be clearly labelled with full well name, API number, and depth range of samples within container. Labels should be clearly visible on containers and written with water-resistant ink.
- Each container should include an inventory list of the cuttings within that container.
- 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 and according to the program discussed with the technical team. Bluebonnet Hub 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 Bluebonnet Hub SME.

3.7 Analysis of Injected CO_2

3.7.1 CO2 Stream Analysis Protocol

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-5 below shows the list of constituents to be analyzed, based on the anticipated composition of the CO_2 stream.

Table QASP-5: CO_2 stream analysis.

Claimed as PBI

[redacted]

3.7.2 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 the front-end engineering and design (FEED) and will follow contractor protocols to ensure samples are 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.

3.7.3 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. Bluebonnet Hub reserves the right to review and audit the protocols and methods of the selected laboratory before awarding the work.

3.7.4 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, the relative humidity should be 95% or less so there is no condensation.

Table QASP-6: Sampling methods summary

Claimed as PBI

[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 QASP-7).

Table QASP-7: Isotopes Sampled for Identification

Claimed as PBI [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 and 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 calibrating and maintaining the measurement equipment as well as the disposing the samples when the analysis is finished.

Table QASP-8: Analytical methods.

Parameters	Analytical Method	Resolution Instruments	Precisions/Std Dev
Mass	NACE SP0775-2018-SC	0.05 mg	2%
Thickness	NACE SP0775-2018-SC	0.01 mm	± 0.05 mm

Notes:

- NACE SP0775-2018-SC – Preparation, Installation, Analysis, and Interpretation of Corrosion Coupons in Oilfield Operations

4.2.3 Quality Control

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

4.3 Soil Gas Sampling

The method for soil gas sampling is described in Section 8.1 of the Testing and Monitoring Plan. The samples will be sent to specialized laboratory to determine gas composition and perform isotopic analysis to characterize the fluid and get a fingerprint for future 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-9.

Table QASP-9: Soil gas analysis parameters.

Claimed as PBI [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 be able 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:

1. Claimed as PBI [redacted]

2. Claimed as PBI [redacted]

Table QASP-10: Field measurement stability criteria.

Claimed as PBI [redacted]

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. The Bluebonnet Hub reserves the right to audit the procedures and results of the selected laboratory with a third party 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 standard methods for water analysis. Laboratories shall have standard operating procedures for the analytical methods performed.

Table QASP-11: Analytical method selected for various parameters.

Claimed as PBI

[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-12). Bluebonnet Hub 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 at the surface via real-time P/T instruments installed in the CO_2 flowline near the interface with the wellhead. The flow rate of CO_2 injected into the wellhead will be measured by flowmeter skids with a Coriolis meters. Automated shutoff devices will be used to stop injection if injection parameters deviate outside operational limits.

Table QASP-12: Technical specification for surface pressure transducers.

Claimed as PBI

Table QASP-13: Technical specification for surface temperature transducers.

Claimed as PBI

P/T 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 CO_2 service conditions, and the data will be integrated into the SCADA system and surveillance platform. Table QASP-14 shows an example of the technical specifications for downhole gauges.

Table QASP-14: Technical specifications for downhole P/T sensors.

Claimed as PBI [redacted]

The flow rate of CO_2 injected into the well will be measured by f Claimed as PBI [redacted] Table QASP-15 is an example of typical meter specifications.

Table QASP-15: Example of Coriolis meter specifications.

Claimed as PBI [redacted]

Automated shutdown valves will be used to stop the flow of CO_2 to the well in the event that operation parameters deviate from program operational limits. The valves are currently planned as ASME 1500 RF trunnion ball, full port, CS x SS, soft seated, gear operated, NACE, with electrically operated actuator, but will be confirmed during detailed engineering of the surface facilities.

<u>7.0 CO_2 Injection Well – Well Testing</u>

Claimed as PBI

[redacted]

[redacted]

[redacted]

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

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Claimed as PBI [redacted]

[redacted] Figure QASP-1.

Claimed as PBI [redacted]

Figure QASP-1 Step Rate Data Plot Example

7.2 Injectivity Test

Claimed as PBI [redacted]

[redacted]

[redacted]

[redacted]

- [redacted]

- Claimed as PBI [redacted]

[redacted]

Claimed as PBI

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Table QASP-17: Fiber optic cable technical specifications.

Claimed as PBI [redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

9.0 Leak Detection

9.1 Optical Gas Imaging Camera

Optical Gas Imaging (OGI) cameras use unique spectral filters that enable them to detect a gas compound. 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 facilities, pipelines, wells, and other equipment at the Project.

Table QASP- 18 FLIR Optical Gas Imaging Camera Specifications

Claimed as PBI

[redacted]

9.2 Atmospheric CO_2 Sensor

Table QASP-19: Infrared gas detector specifications.

Claimed as PBI

[redacted]

Bluebonnet Hub 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-20: Wellhead atmospheric CO_2 sensor specification example

Claimed as PBI

[redacted]

10.0 Induced Seismicity Tracking

Bluebonnet Hub 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.

Changes 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, the project proposes deploying surface seismometer stations. While the historical seismicity of the project area indicates no earthquakes in the immediate vicinity, the Bluebonnet Hub 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 the injection wells.

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 the injection wells, Bluebonnet Hub will implement its response plan subject to detected earthquake magnitude limits defined below to eliminate or reduce the magnitude and/or frequency of seismic events. Traffic Light System is described in the Testing and Monitoring Plan section 9.2.

10.1.1 Personnel

The design and installation of the station array will be performed by specialized contractors and will include 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 perform commissioning.
- Data acquisition, system configuration, and process setup.
- Continuous support and monitoring for data verification and QA/QC.
- 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-2 shows the technical specifications for broadband seismometer as a reference.

Figure QASP-3 shows an example of a setup for data acquisition, transfer, storage, and analysis.

Claimed as PBI

[redacted]

Figure QASP-2: Technical specification for a broadband seismometer.

Claimed as PBI

[redacted]

Figure QASP-3: Data acquisition setup example.

11.0 <u>Open Hole and Cased Hole Wireline Logs Technical Specification and Procedures</u>

See Appendix QASP-A.

<u>12.0 References</u>

- EPA Region 6 Falloff Guidelines
- SPE Monograph 5, “Advances in Well Test Analysis,” 1977, Robert Earlougher, Jr.