BROWN PELICAN CO_2 SEQUESTRATION PROJECT MONITORING, REPORTING, AND VERIFICATION (MRV) PLAN

Facility Information:

Company: Oxy Low Carbon Ventures, LLC (OLCV)
Facility Name: Brown Pelican CO_2 Sequestration Project (BRP Project)
UIC Class VI Well Names and Numbers:
BRP CCS1, UIC number TBD
BRP CCS2, UIC number TBD
BRP CCS3, UIC number TBD
UIC CLASS VI Permit Number: R06-TX-0005
EPAGHGRP Reporting Number: In progress

Version Date: July 2025

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LIST OF ACRONYMS AND ABBREVIATIONS

AGA - American Gas Association
AMA – Active Monitoring Area
AoR – Area of Review
API – American Petroleum Institute
BRP Project – Brown Pelican CO_2 Sequestration Project
$CaCO_3$ – Calcium carbonate
CO_2 – Carbon Dioxide
CRA – Corrosion Resistant Alloy
DAC – Direct Air Capture
DInSAR - Differential Interferometric Synthetic-Aperture Radar
EOR – Enhanced Oil Recovery
EPA – Environmental Protection Agency
GPA - Gas Processors Association
GPS – Global Positioning System
K - Permeability
mD – Millidarcy
MD – Measured Depth
mi – mile
MIT – Mechanical Integrity Test
ML – Magnitude level
MMA – Maximum Monitoring Area
MMT – Million Metric Tons
MRV – Monitoring, Reporting, and Verification
MTX – Midland Texas subscriber array
NOx – Nitrogen oxides
OGI – Optical Gas Imaging
OLCV – Oxy Low Carbon Ventures
Ppm – Parts per million
SCADA – Supervisory Control and Data Acquisition
Sox – Sulfur oxides
SSTVD – True Vertical Depth Subsea
TCEQ – Texas Commission on Environmental Quality
TexNet – Texas Seismological Network and Seismology Research
TRRC – The Railroad Commission of Texas
UIC – Underground Injection Control
USDW – Underground Source of Drinking Water
USGS – United States Geological Survey
UWI – Unique Well Identifier
VSP – Vertical Seismic Profile
XGR – Gammy Ray log evaluated by Petrophysicists at Oxy or OLCV
XPOR – Porosity log evaluated by Petrophysicists at Oxy or OLCV
2D – Two dimensional
3D – Three dimensional

1.0 PROJECT DESCRIPTION

Oxy Low Carbon Ventures, LLC (OLCV), a wholly owned subsidiary of Occidental Petroleum Corporation (Oxy), is developing the Brown Pelican Carbon Dioxide (CO_2) Sequestration Project (BRP Project or Project) that is located approximately 20 miles southwest of Odessa, in Ector County, Texas (See Figure 1). The Stratos Direct Air Capture (DAC) facility will deliver CO_2 to the BRP Project, where it will be sequestered in the Lower San Andres Formation utilizing three Underground Injection Control (UIC) Class VI injection wells (BRP CCS1, BRP CCS2, and BRP CCS3). The CO_2 will be transported from Stratos to the UIC Class VI injection wells via a short pipeline. The BRP Project's design capacity is 8.5 million Metric Tons (MMT) of CO_2 over 12 years.

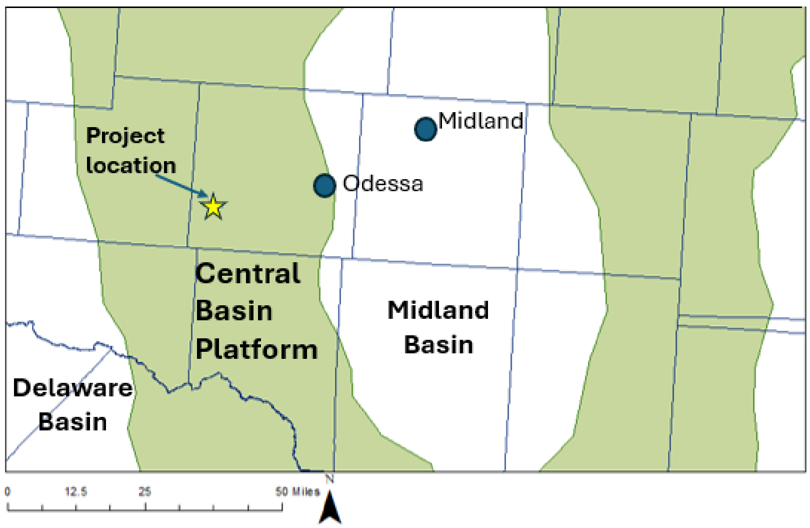

Figure 1—BRP Project Location.

This Monitoring, Verification and Reporting (MRV) plan was developed in accordance with 40 CFR §98.440-449 to provide for the monitoring, reporting, and verification of the quantity of CO_2 sequestered over the life of the BRP Project.

2.0 SITE CHARACTERIZATION

OLCV conducted a detailed site characterization based on a regional and site-specific geologic and hydrologic evaluation for the BRP Project area using geologic, geophysical, and petrophysical data obtained from public literature, OLCV-licensed data, and data acquired from 11 wells constructed for the Project.

In November 2022, OLCV acquired high-density 3D seismic data in an area of ~20 square miles that encompasses the BRP Project Area of Review (AoR) and surrounding area. Two orthogonal 2D lines totaling 10 line-miles were acquired in addition to the 3D survey. OLCV designed seismic processing workflows to detect and image faults in the BRP Project AoR. Two parallel seismic processing flows were implemented: one flow focused on amplitude preservation for reliable quantitative interpretation, and the other focused on providing the best image for structural interpretation (the latter being used for fault interpretation). Fault detection attributes were extracted on full bandwidth data as well as the low, medium, and high frequencies and checked with manual interpretation. No faults are imaged or suspected in the Injection Zone, Lower Confining Zone, or Upper Confining Zone and System.

OLCV constructed 11 new wells in 2023 and 2024 to characterize and monitor the Project site: two stratigraphic test wells that OLCV converted to monitoring wells, three wells drilled pursuant to authorization from the Railroad Commission of Texas (RRC) that, once permitted, will serve as UIC Class VI injection wells, four brine withdrawal wells, and two monitoring wells.

The rock and fluid properties obtained from wells were calibrated to seismic facies and extrapolated beyond the wellbores, providing a robust geologic and petrophysical characterization of the Injection Zone, Upper and Lower Confining Zones, and Upper Confining System. The resulting geocellular model was used as the basis for a dynamic simulation model. This model will be calibrated with operational data, and if warranted, the Area of Review and Corrective Action Plan will be reevaluated and amended [40 CFR 146.84(e)].

2.1 Geologic setting

2.1.1 Regional geologic setting

The BRP Project is located on the Central Basin Platform that is part of the Permian Basin (Figure 1). The Permian Basin formed during the Late Mississippian to Early Pennsylvanian convergent plate motion of the South American (Gondwanan) plate along the southern margin of the North American (Laurentian) plate (Ross 1986; McBride 1989; Reed and Strickler 1990; Yang and Dorobek 1995). Older, Neoproterozoic-Cambrian age rifting created deep, basement-involved faults in the Permian Basin that influenced the structure formed during the Permian convergence (Mosher et al. 2004, Ewing et al. 2019). Minimal tectonic deformation occurred on the Central Basin Platform since the late Paleozoic, so the present-day structural features are essentially the same as those inherited from Proterozoic–Early Permian orogenic events (Hills 1984; Ward et al. 1986; Ewing et al. 1993; Yang and Dorobek 1995).

The Permian Basin stratigraphy of West Texas and New Mexico consists of Wolfcampian to Late Ochoan mixed carbonate-siliciclastic-evaporite strata. Platform top depositional environments include the following: salty anhydritic salinas, siliciclastic-rich eolian dunes, carbonate-rich tidal flats, oolitic shorelines and tidal bars, and open-marine shelves (Silver and Todd 1969). The Delaware and Midland basins consist of sand-filled, slope-incised channels and silt-rich slopes that pass basinward into deep-marine (500- to 1,800-ft water depths) turbiditic sandstones and pelagic mudstones (King 1948; Gardner et al. 2003). Formation-scale stratigraphic units provide a complex record of episodic deposition that was driven by the rise and fall of sea levels (100+ ft) (Meissner 1972). This record is characterized by periods of sediment starvation within the basins concurrent with development of basin-fringing carbonate platforms, followed by periods of platform erosion and sediment bypass to the basin floor. During the Late Permian, the Midland Basin became the site of a large evaporitic flat, as recorded by the shallow marine deposits of the Queen Formation. In contrast, the Delaware Basin was infilled by the Late Permian Castile and Salado evaporites that were ultimately deposited across the entire Permian Basin region, including the Northwest Shelf and Central Basin Platform (King 1948).

2.1.2 Site-specific geologic setting

OLCV interpreted site-specific 3D seismic data to identify the structural setting for the BRP Project area. The Permian-age stratigraphy dips gently towards the West at 0.7° (170 ft vertically over 12,500 ft laterally) across the Project area. OLCV mapped basement-rooted faults that terminate at the Pennsylvanian Unconformity in the Wolfcamp formation, which is approximately 2500 feet below base of the Injection Zone. OLCV identified the absence of faults in the Project area above the Wolfcamp formation. Therefore, no faults are interpreted to intersect the Injection Zone or Confining Zones in the AoR. This interpretation is consistent with regional interpretations found in literature (Ewing et al. 2019).

Based on site-specific geomechanical data, it is unlikely that deep-seated faults will be reactivated due to shallower injection of CO_2 by either direct pressure transfer from the reservoir to the basement or by poroelastic strain transfer from the reservoir to the basement. Furthermore, the proposed Project site is situated in an area of West Texas that has historically exhibited low seismic activity, based on catalogs from both United States Geological Survey (USGS)[1] and TexNet[2].

OLCV defined the Lower San Andres as the Injection Zone and it consists of a succession of stacked wackestone, to grain-dominated packstone, to tidal flat mudstone facies that are indicative of a carbonate ramp depositional environment. The succession represents a progression from deeper to shallower depositional environment. From top to bottom: 1) Tidal flat facies that are indicative of shallow water depths within feet of the paleo sea level; 2) Fusulinid-brachiopod-rich dolopackstones that represent the key reservoir facies in the succession and indicate a water depth of around 60 ft; and 3) Dolowackestone facies indicate a water depth of around 100+ feet. The average porosity in the Injection Zone ranges from 9.4 - 11.2% and average permeability ranges from 1.2 – 18.8 mD. The average gross thickness of the Lower San Andres formation in the AoR is approximately 675 feet.

OLCV defined the Upper San Andres and Grayburg formations as the Upper Confining Zone. Based

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[1] https://earthquake.usgs.gov/earthquakes/search/

[2] https://www.beg.utexas.edu/texnet-cisr

on data obtained in the AoR, these formations are composed of wackestone with pervasive anhydrite and chert nodules. Site-specific data from log, whole core, and rotary sidewall core indicated the porosity of these formations is 3-5% and the average permeability is <0.01 mD. These rocks are interpreted to have been deposited in a low energy, shallow subtidal to outer ramp depositional environment. Subsequent diagenetic events consisted of dolomitization, leaching, and porosity-occluding precipitation of anhydrite, which resulted in the observed low-permeability rock fabric. The thickness of the Upper San Andres and Grayburg formations in the AoR is approximately 580 - 650 feet thick.

OLCV defined the Queen, Seven Rivers, Yates, Tansill, and Rustler formations as the Upper Confining System. Based on data obtained in the AoR, these formations are composed of anhydrite, halite, shale, and tight silt. The porosity based on well logs is 3-5% and the average permeability is estimated to be <0.01 mD. These rocks are interpreted to have been deposited in highly evaporitic, shallow subtidal to supratidal depositional environments. Subsequent diagenetic events consisted of dolomitization, leaching, and porosity-occluding precipitation of anhydrite, calcite, and silica cement, which resulted in the observed low-permeability rock fabric. The thickness of the Upper Confining System ranges between approximately 2,620 – 2,710 ft thick in the AoR.

OLCV defined the Lower Confining Zone as the Upper Glorieta formation. It is dominated by tidal flat mudstones and massive anhydrite with low porosity, ~5 %, and low permeability, < 0.01 mD permeability. The Upper Glorieta formation is approximately 360 – 370 feet thick in the AoR.

The CO_2 Storage Complex consists of four main elements and is summarized in Figure 2:

1. Injection Zone (Lower San Andres Formation that is divided into three sub-zones: Holt, G1, and G4);
2. Upper Confining Zone (Upper San Andres and Grayburg Formations)
3. Regional Seal / Upper Confining System (Queen through Rustler Formations); and
4. Lower Confining Zone (Upper Glorieta Formation).

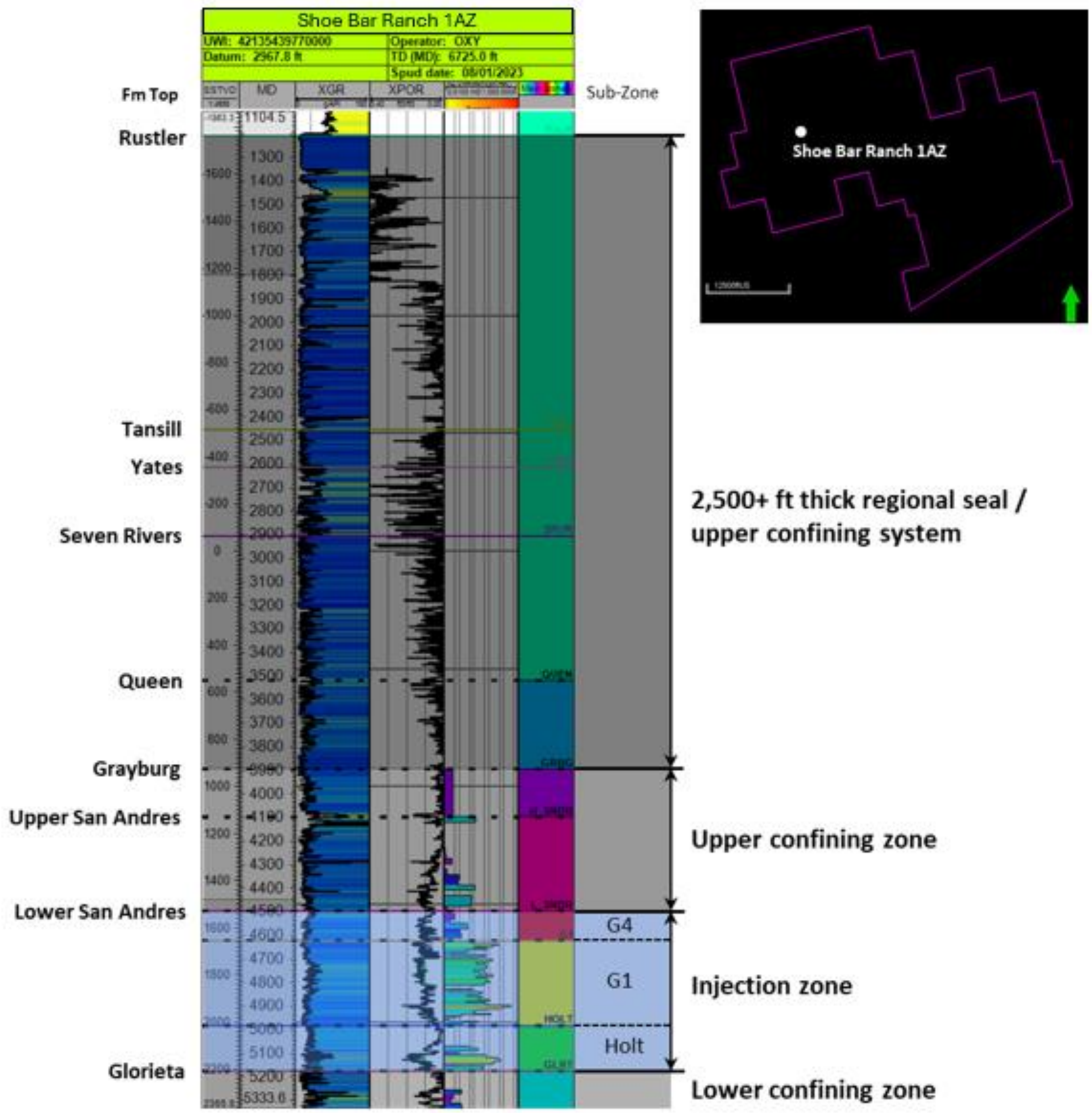

Figure 2— Stratigraphic column covering the Injection Zone, Upper Confining Zone, and Upper Confining System. UWI = Unique Well Identifier; SSTVD = True vertical depth subsea; TD = Total Depth; MD = Measured depth; XGR = Gamma Ray log QCd by Oxy or OLCV petrophysicist; XPOR = porosity log QCd by Oxy or OLCV petrophysicist; K = Permeability

2.2 Historical Use of the Subsurface and Surface in the Project Area

The BRP Project is situated in the northern part of the Shoe Bar Ranch in an area previously, but no longer, used as ranchland. There is no mineral production from the subsurface under the Project area and there is no historical oil and gas production within the BRP Project AoR plus a half-mile buffer, which is coincident with the Active Monitoring Area (AMA) and Maximum Monitoring Area (MMA). The AMA and MMA are described in Section 5 of this document. The proposed storage complex is located approximately five miles northwest of the Penwell oilfield and is stratigraphically isolated from oil and gas production in that field.

3.0 DESCRIPTION OF CO_2 PROJECT FACILITIES AND INJECTION PROCESS

3.1 Description of Project wells

The BRP Project consists of three UIC Class VI CO_2 injection wells, two wells to monitor the Injection Zone, two wells to monitor the Confining Zone and one well to monitor the USDW. In addition, OLCV will utilize four brine withdrawal wells to manage pressure within the AoR, as further described in Section 6.3. The produced brine will be utilized or disposed offsite. OLCV may seek authorization to drill additional wells in the future to meet Project goals. The construction and operation of any additional future wells will be regulated by TRRC, TCEQ, or EPA, depending on well type.

Prior to commencement of CO_2 injection, all of the monitoring wells will be constructed except for the SLR3, which OLCV anticipates constructing approximately five years after the commencement of CO_2 injection. OLCV will review the proposed location of the SLR3 and may refine the location based on information obtained about the AoR after start-up of CO_2 injection operations.

Table 1 below lists the Project wells. Figure 3 below shows a map of the site.

Table 1—List of Project wells

API or State well number	Project Well Name	Regulatory Well Name	Purpose	Drill Date	Anticipated Plug Date	Latitude (NAD 27)	Longitude (NAD 27)
4213544040	BRP CCS1	Shoe Bar Ranch 1CS	CO_2 injector	2024	End of Injection Period	31.76481926	-102.72891895
4213544041	BRP CCS2	Shoe Bar Ranch 2CS	CO_2 injector	2024	End of Injection Period	31.76994887	-102.73320589
4213544062	BRP CCS3	Shoe Bar Ranch 3CS	CO_2 injector	2024	End of Injection Period	31.76024766	-102.71013484
4213544065	SLR2	Shoe Bar Ranch 2SL	Injection Zone monitor	2025	~20 years post Injection Period	31.74657954	-102.72586378
4213543920	SLR1	Shoe Bar Ranch 1	Stratigraphic test, Confining Zone monitor	2023	2025[1] and ~10 years post Injection Period	31.76343592	-102.70349808
4213543977	ACZ1	Shoe Bar Ranch 1AZ	Stratigraphic test, Confining Zone monitor	2023	2025[1] and ~10 years post Injection Period	31.76448867	-102.73053251
657173	USDW1	Shoe Bar Monitor Well #1	USDW monitor	2024	~20 years post Injection Period	31.76411900	-102.7316750
4213544035	WW1	Shoe Bar Ranch 1WW	Brine withdrawal, Injection Zone monitor	2024	End of Injection Period	31.76289537	-102.69592320
4213544036	WW2	Shoe Bar Ranch 2WW	Brine withdrawal, Injection Zone monitor	2024	After ~seven years of injection[2] End of Injection Period	31.78419970	-102.72758691
4213544037	WW3	Shoe Bar Ranch 3WW	Brine withdrawal, Injection Zone monitor	2024	End of Injection Period	31.75008559	-102.71022070
4213544034	WW4	Shoe Bar Ranch 4WW	Brine withdrawal, Injection Zone monitor	2024	End of Injection Period	31.76384466	-102.75395043
NA	SLR3	Shoe Bar Ranch 3SL	Injection Zone monitor	~2030; ~5 years after commence-ment of CO_2 injection	~10 years post Injection Period	31.78023685	-102.7418093

[1]conversion from stratigraphic test well to monitor well
[2]plugging of Holt subzone

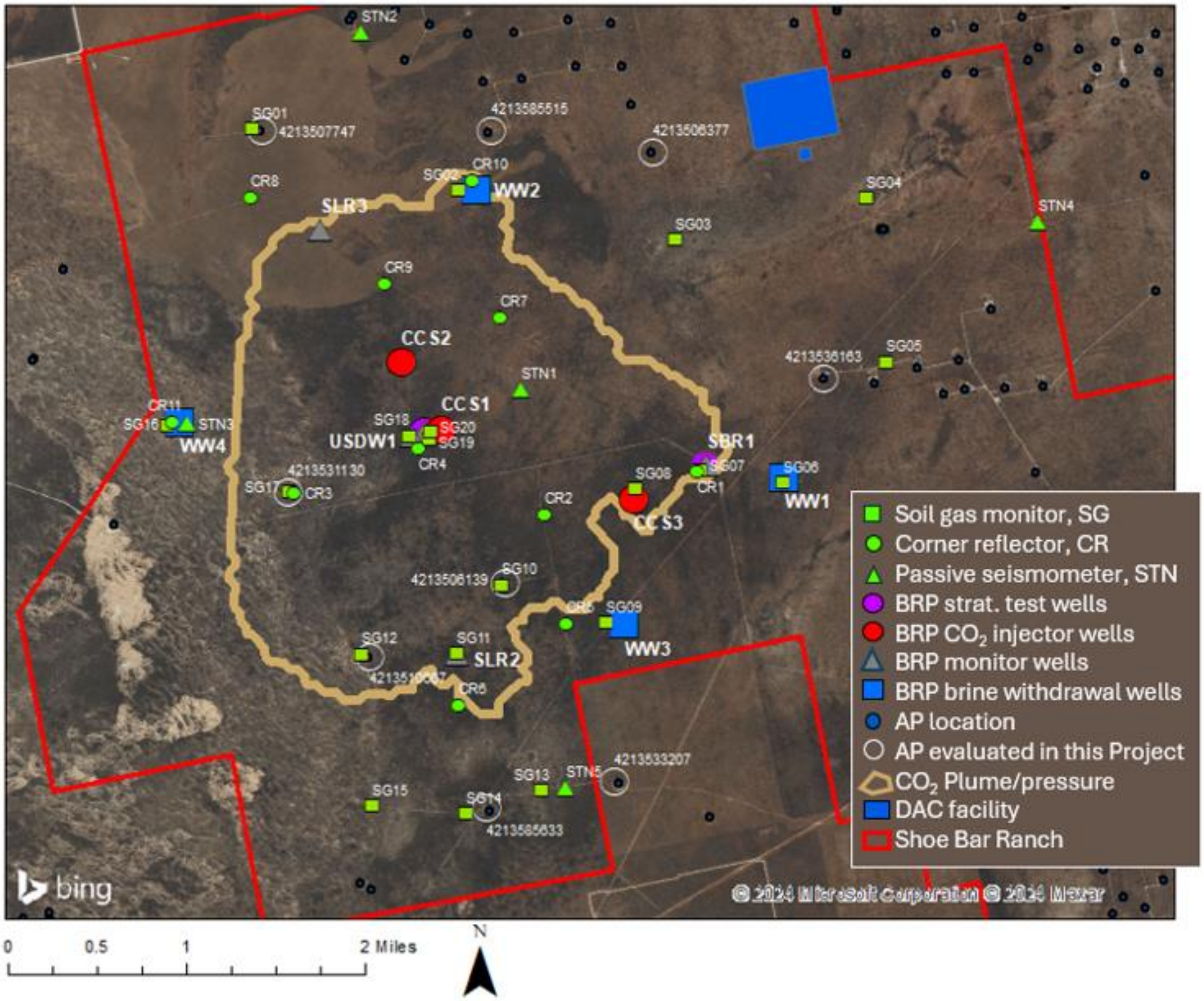

Figure 3—Map of BRP Project area including outline of Shoe Bar Ranch, the combined CO_2 plume and pressure plume (the AoR), wells, facilities, and monitoring locations. Explanation: SG = Soil gas monitor, CR = Corner Reflector, STN = seismometer station, AP = Artificial Penetration, DAC = Stratos Direct Air Capture Facility.

3.2 CO_2 Injectate Stream

Figure 3 above shows the injection and monitoring facilities for the BRP Project. OLCV will capture CO_2 at the Stratos facility, compress the gas, and transport it through a pipeline that is approximately 5.5-miles long for injection at the BRP Project.

The injectate stream from Stratos will be composed of 95% or greater CO_2. The remaining components include minor amounts of water (<30 lbm/MMscf), Nitrogen, (<4 mol%), Sulphur (<35 ppm by weight), Oxygen (<5 mol%), Glycol (<0.3 gal/MMscf), Carbon Monoxide (<4,250 ppm by weight), NOx (<6 ppm by weight), SOx (<1 ppm by weight), $CaCO_3$ (<1 ppm by weight), and Argon (<1 mol%). OLCV will continuously monitor and routinely sample the CO_2 injectate stream at a port in the pipeline located near the CO_2 custody transfer meter, and directly upstream of the CO_2 injector wellheads to confirm conformance to the standard CO_2 specification.

3.3 Class VI Well Construction and Injection Operations

OLCV will inject CO_2 into the Lower San Andres formation utilizing three wells that were constructed in 2024 and meet or exceed UIC Class VI standards. These three wells will serve as CO_2 injection wells once all required regulatory approvals, including required UIC Class VI permits are received.

The design parameters and material selection for the wells built to UIC Class VI standards are aimed to ensure mechanical integrity and to optimize operational life of the equipment. The UIC Class VI well design includes three main casing sections: 1) surface casing to cover the USDW and provide integrity while drilling to the Injection Zone, 2) intermediate casing section, and 3) a long string casing section to acquire formation data and isolate the target formation while running the upper completion equipment. Casing string materials for the UIC Class VI wells are selected based on the operating and other subsurface conditions and to minimize corrosion risk. Casing is made of alloy steel in zones where there is low risk of CO_2 contact with the casing. In zones where casing will be in contact with the CO_2 and formation fluids, the casing will be composed of a corrosion resistant alloy (CRA). To ensure long term barrier integrity under anticipated CO_2 conditions at and near the Injection Zone, the cement slurry is designed to improve chemical and mechanical resistance to the effects of carbonic acid exposure. Tubing, packers, and gauges will be composed of, or coated with, materials that are suitable for CO_2-rich brine environments.

OLCV conducted a pre-operational testing program during well construction to determine and verify the depth, thickness, mineralogy, lithology, porosity, permeability, and geomechanical properties of the Injection Zone, the overlying Upper Confining Zone, and other relevant geologic formations. In addition, formation fluid characteristics of the Injection Zone were obtained to establish baseline data against which future measurements may be compared after the start of CO_2 injection operations.

During CO_2 injection operations, injection flow rates will be controlled with choke valves and measured with a Coriolis meter. Pressure at the UIC Class VI injection wells will be controlled via control valves with shutdown protocols in place to protect the well in the event of a high-pressure scenario**.** Automatic alarms and automatic shutoff systems will be installed and maintained (40 CFR 146.88(e)). Other than periods of well maintenance, OLCV will maintain mechanical integrity on the UIC Class VI injection wells (40 CFR 146.88(d)). OLCV will operate its UIC Class VI wells to comply with the maximum pressures permitted by regulation and as specified in its permits.

3.4 Monitoring Operations

During and after CO_2 injection operations, the BRP Project site will be monitored by a suite of techniques in the Injection Zone, above the Confining Zone, and at the surface (see Figure 3 for monitoring locations). In the Injection Zone, OLCV will obtain pressure, temperature, and geochemical data on fluids and dissolved gases from monitoring wells and brine withdrawal wells. The USDW will be monitored using geochemical analyses of fluids and dissolved gases. The geochemistry of soils and soil gases inside and adjacent to the AoR will be monitored. In addition, the location of CO_2 in the subsurface and pressure in the Injection Zone will be indirectly monitored using a number of methods including Vertical Seismic Profiles (VSPs) and 2D surface seismic. OLCV will also utilize Differential Interferometric Synthetic-Aperture Radar (DInSAR) and Global Positioning Systems (GPS) data to indirectly monitor the position of CO_2 in the Injection Zone.

During CO_2 injection operations at the UIC Class VI wells, injection pressure, injection rate, injected volume and annulus pressure will be continuously monitored to confirm mechanical integrity within the injection tubing, casing, and packers. OLCV will conduct temperature logging and other logs to confirm mechanical integrity on an annual basis. OLCV will monitor well materials during the operation period for loss of mass, thickness, cracking, pitting, and other signs of corrosion to verify that the well components meet the minimum standards for material strength and performance. In addition to monitoring corrosion coupons, OLCV will conduct visual inspection of the facilities and utilize optical gas imaging cameras (OGI) to monitor for potential CO_2 leakage.

More details on monitoring and testing are presented in Section 7 of this document.

4.0 MODELING THE AOR

4.1 Geocellular model

The static geocellular framework was constructed by modeling large-scale stratigraphic and structural features and then applying the petrophysical properties of these geologic features. The structure was mapped based on seismic data and well-based formation tops in areas where seismic data were unavailable. The available 2D and 3D seismic data indicate no faults penetrating the Injection Zone or Upper or Lower Confining Zone in an area of approximately 20 mi^2 encompassing the BRP Project and surrounding area. The geocellular model contains the following four intervals: the Upper Confining Zone defined as the Grayburg and Upper San Andres formations; the Injection Zone defined as the Lower San Andres Formation; and the Lower Confining Zone defined as the Upper Glorieta Formation. The areal extent of the geocellular model covers the Shoe Bar Ranch plus a 1-mile buffer zone.

4.2 Dynamic Simulation Model and Definition of the AoR

OLCV upscaled the geocellular model and performed 3D dynamic reservoir simulations using full physics and an equation of state. The dynamic simulation model includes three CO_2 injection wells and four brine withdrawal wells for the purpose of pressure maintenance. Based on capillary pressure data, no-flow boundary conditions were applied to the upper and lower boundaries of the model, and the Injection Zone and Confining Zones are interpreted to be continuous throughout the model.

The simulation model forecast of CO_2 injection and brine withdrawal begins by using reservoir pressure data acquired in the Shoe Bar Ranch 1 and Shoe Bar Ranch 1AZ stratigraphic test wells. UIC Class VI injection wells and brine withdrawal wells are operated for 12 years and are then shut-in. The simulation continues for another 50 years post-injection to simulate CO_2 migration in the post-injection period.

The AoR is defined by the critical pressure threshold at which an increase in pore pressure is high enough to overcome the hydraulic head of the fluid in a hypothetical wellbore and enter the USDW. At the BRP project site, the AoR represents the maximum extent of pressure from three injection wells at the end of 12 years of CO_2 injection and the maximum extent of the CO_2 plume 50 years after injection ceases. The AoR is modeled to be approximately 5.4 square miles. The CO_2 plume and the pressure plume are approximately the same shape and size at the BRP Project, because the size of the pressure plume is constrained by brine removal from the Injection Zone. The areal extent of the AoR, geocellular model and the simulation model are shown in Figure 4.

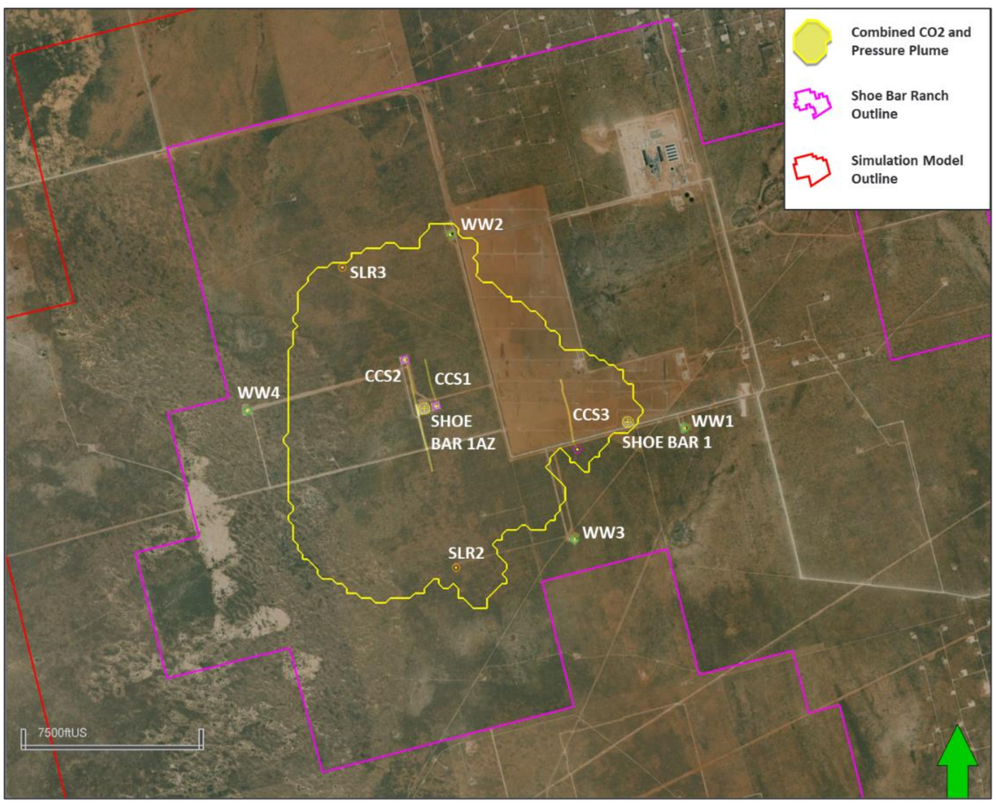

Figure 4—Outline of geocellular model and dynamic simulation model, outline of the Shoe Bar Ranch, combined AoR showing pressure and CO_2 plumes, and selected Project wells.

4.3 Existing Artificial Penetrations in the AoR and Corrective Action Plans

4.3.1 Identification of Artificial Penetrations

As part of its process to identify potential CO_2 Surface Leakage pathways that could potentially impact the BRP Project site, OLCV evaluated the location and status of legacy Artificial Penetrations (APs) within the AoR that may require re-entry and corrective action. OLCV also evaluated APs within the MMA (See Section 5 for a description of the MMA). A total of five legacy APs are located in the MMA: three are located within the AoR and penetrate the Injection Zone; one is located outside the AoR and penetrates the Injection Zone; and one is located in the AoR and penetrates the USDW. Corrective action was performed on legacy APs in the AoR (See section 4.3.2).

Table 2 indicates the legacy APs in the AoR and legacy APs in the MMA. Table 3 indicates the records available for these legacy APs.

Table 2—Locations of legacy APs in BRP AoR* and MMA.**

						From Public and Licensed sources	
API or state well number	**Well Name**	**Recorded Status**	**Drill Date**	**Abandon Date**	**Corrective Action Date**	**Latitude NAD27**	**Longitude NAD27**
4213506139*	Eidson-Scharbauer-1	Dry hole	4/18/1958	9/21/1959	2/26/2025	31.7526374	-102.7218925
4213510667*	Scharbauer Eidson-1	Dry hole	12/23/1964	2/19/1965	2/26/2025	31.7460090	-102.7343253
4213531130*	Eidson E-1	Dry hole	8/1/1973	8/23/1973	2/26/2025	31.7587481	-102.7431169
4511701*	-	Brackish water producer	1940	9/20/2023	No corrective action required	31.7719430	-102.7205540
4213585515 /4213510921**	Eidson E-1WD	Injector, plugged	Unknown	7/2/1990	Not in the AoR; no corrective action required	31.7891145	-102.7263252

Note: Excludes wells drilled for the BRP Project.

*Located in the AoR.

**Not located in the AoR and does not require corrective action.

Table 3—Public records search results for APs in BRP AoR* and MMA.**

		Source					
API or well number	**Well Name**	**TRRC_D**	**TRRC_H**	**TCEQ**	**TDLR**	**TWDB**	**BEG**
4213506139*	Eidson-Scharbauer-1	No records	Plugging record	No records	No records	No records	No records
4213510667*	Scharbauer Eidson-1	No records	Plugging record	No records	No records	No records	No records
4213531130*	Eidson E-1	No records	Plugging record	No records	No records	No records	No records
4511701*	-	No records	No records	No records	No records	well schedule and water quality analysis	No records
4213585515/ 4213510921**	Eidson E-1WD	disposal permit, well potential, and plugging record	Well potential and plugging record	No records	No records	No records	No records

TRRC_D = Digitally available records.
TRRC_H = Hardcopy or microfilm/microfiche records available.
Excludes wells drilled for the BRP Project.
*Located in the AoR.
**Not located in the AoR and does not require corrective action.

4.3.2 Corrective Action Plans

On behalf of OLCV, Oxy conducted corrective action on three legacy APs in the AoR: Eidson E-1 (API 4213531130), Scharbauer Eidson-1 (API 4213510667) and Eidson-Scharbauer-1 (API 4213506139). The purpose of corrective action was to prevent the wells from serving as conduits for the movement of fluids into USDWs (40 CFR 146.81). Corrective action operations included re-entering the wells and then re-plugging and abandoning them. Corrective action operations were completed in February 2025, prior to commencement of CO_2 injection operations.

The brackish water producer, state well number 4511701, was plugged and abandoned by a qualified water well driller supervised by Oxy and OLCV in 2023 and no further corrective actions are required.

OLCV identified one AP within a half-mile of the AoR, Eidson E-1WD (API 4213585515 / 4213510921). This well is not located in the AoR. No corrective action is required or anticipated based on current dynamic simulation modeling of the AoR.

5.0 DELINEATION OF MONITORING AREA AND TIMEFRAMES

5.1 Active Monitoring Area

The AMA for the BRP Project is defined by the boundary of the AoR plus the required one-half mile buffer. See Section 4.2 of this document for a description of the AoR. The AMA is consistent with the requirements in 40 CFR §98.449 because it is the area projected:

(1) to contain the free phase CO_2 plume for the duration of the project (year t), plus an all-around buffer zone of one-half mile.

(2) to contain the free phase CO_2 plume for at least 5 years after injection ceases (year t + 5).

Year "t" represents the end of the Injection Period, which occurs 12 years after commencement of CO_2 injection. The separate-phase CO_2 plume at five years after CO_2 injection ceases (year 17) is projected to be contained within the AoR, which has been modeled to year 62. If modeling results necessitate a change in the AMA, OLCV will submit a revised MRV plan.

5.2 Maximum Monitoring Area

The MMA for the BRP Project is defined by the boundary of the AoR plus one-half mile buffer and is the same as the AMA. The MMA is consistent with the requirements in 40 CFR §98.449 because the AoR is defined as the combination of the maximum CO_2 plume and maximum pressure front. See Section 4.2 of this document for a description of the AoR. Modeling results are consistent with CO_2 plume stabilization 50 years after the cessation of CO_2 injection. If modeling results necessitate a change in the MMA, OLCV will submit a revised MRV plan.

Figure 5 shows the AMA and MMA.

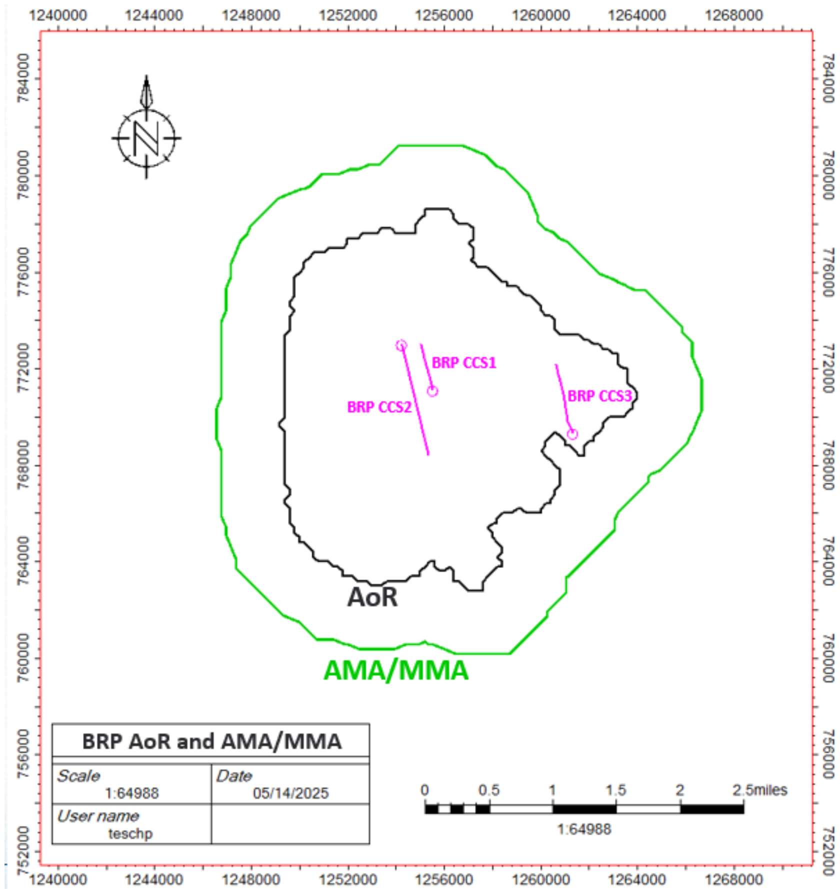

Figure 5—Outline of the BRP Project AoR, AMA, and MMA.

5.3 Monitoring Time Frames

The monitoring program for geologic storage of CO_2 comprises three distinct periods: 1) pre-operational baseline characterization, 2) operational monitoring during CO_2 injection, and 3) post-operational monitoring after injection of CO_2 ceases. These monitoring periods encompass the entire life cycle of the BRP Project. For purposes of this MRV plan, OLCV expects that reporting will be initiated during the Injection Period and continue through Post-injection Site Care (PISC) until site closure is obtained or unless discontinued pursuant to 40 CFR §98.441(b).

The storage system parameters, purpose, and timing for monitoring vary by period as follows:

- Pre-operational baseline characterization establishes the pre-CO_2 injection conditions of the storage system and inherent uncertainty associated with the measurement of each of the key storage system parameters. If results from this pre-operational monitoring period necessitate changes to this MRV plan, an amendment will be submitted prior to the start of Class VI CO_2 injection operations. The baseline characterization will be conducted for approximately one year prior to the commencement of CO_2 injection.

- Monitoring during the Injection Period is focused on validating and updating the dynamic simulation model of the BRP Project area, verifying that the Project is operating safely, protecting USDWs, and collecting the appropriate data for the mass balance equations. The duration of this period is modeled to be 12 years.

- Lastly, monitoring after CO_2 injection operations cease will verify the stability of the CO_2 plume location and assess the integrity of all plugged wells to demonstrate non-endangerment of USDWs. The duration of this monitoring period is defined to be 50 years, or a time period approved by the Underground Injection Control (UIC) program director pursuant to 40 CFR §146.93(b)(2) or the director of the Oil and Gas Division of the Railroad Commission of Texas, should EPA issue a rule providing Texas primary enforcement authority (primacy) over UIC Class VI.

6.0 EVALUATION OF POTENTIAL CO_2 SURFACE LEAKAGE PATHWAYS

Pursuant to 40 CFR §98.448(a)(2), OLCV conducted an assessment to identify potential CO_2 Surface Leakage pathways in the AoR and MMA. CO_2 Surface Leakage is defined in 40 CFR §98.449 as "movement of the injected CO_2 stream from the Injection Zone to the surface, and into the atmosphere, indoor air, oceans, or surface water." OLCV considered site-specific subsurface characteristics, injection plans, the results of dynamic simulation modeling, and planned monitoring and site care.

OLCV identified the following potential CO_2 Surface Leakage pathways:

- Vertical migration at legacy APs in the AoR and MMA
- Vertical migration at existing and new wellbores constructed for the BRP Project
- Vertical migration through faults and fractures
- Vertical migration resulting from natural or induced seismicity
- Corrosion or surface impacts to wellheads, surface equipment, and piping
- Vertical migration through Upper Confining Zone or Confining System
- Lateral migration outside the AoR and MMA
- Drilling through the AoR and MMA

To mitigate the risk of CO_2 Surface Leakage and to comply with the testing and monitoring requirements for UIC Class VI wells set forth in 40 CFR §146.90, the BRP Project has implemented multiple mitigation methods. OLCV concludes that the risks of CO_2 Surface Leakage are low because of the mitigation measures in place for the Project (See Table 4).

Table 4—Mitigation methods in place to reduce the risk of potential CO_2 Surface Leakage.

Potential CO_2 Surface Leakage Pathway	Mitigation Methods
Legacy APs in the AoR and MMA	Identify legacy APs
	Perform corrective action, as necessary, on legacy APs in the AoR
Existing and new wellbores constructed for the BRP Project	Well and piping constructed with materials appropriate for site specific and CO_2-rich environments
	Wells designed and constructed to isolate the Injection Zone from shallower zones
	Determination of site-specific fracture gradient and resulting determination of injection rate limits
	Designing an operations plan consistent with engineering design specifications for wellbore and piping construction materials
Faults and fractures	Acquisition and interpretation of high-density 3D seismic covering BRP Project area confirming lack of faulting or fracturing in Injection and Confining Zones
	Pressure transient analysis of injectivity test data
Natural or induced seismicity	Evaluation of historical seismicity near the BRP Project site
	Acquisition and interpretation of high-density 3D seismic covering BRP Project area confirming lack of faulting or fracturing in Injection and Confining Zones
Wellheads, surface equipment, and piping	Well and piping constructed with materials appropriate for site-specific and CO_2-rich environments
	Well pads properly maintained, signage and fencing around wellheads; buried pipelines
Upper Confining Zone or Confining System	Acquisition and interpretation of high-density 3D seismic covering BRP Project area confirming presence, thickness, and continuity of Confining Zone
	Wireline log data from site-specific wells to determine thickness, lithology, porosity, fracture pressure, and other rock and fluid properties
	Core data from site-specific wells to determine porosity, permeability, capillary entry pressure, and geomechanical properties
	Geocellular and dynamic simulation modelling to determine operational parameters that prevent fracturing the Injection or Confining Zones
Lateral Migration outside the AoR and MMA	Geocellular and dynamic simulation model calibrated to site-specific data
	Brine withdrawal to control geometry of AoR
Drilling through the AoR and MMA	Regulation by TRRC, TCEQ or EPA
	Deeper zones have been tested and no hydrocarbons are reported to have been identified

Table 5 below describes the likelihood, magnitude, and timing of occurrence if a mitigation method is insufficient to prevent CO_2 Surface Leakage.

Table 5—Potential CO_2 Surface Leakage pathway risk assessment summary.

Potential CO_2 Surface Leakage Pathway	Likelihood of Occurrence	Justification of Likelihood	Magnitude	Justification of Magnitude	Timing when Pathway is a Risk
Legacy APs in the AoR and MMA	Low	Legacy APs are known; corrective action taken before CO_2 injection on	Low	Robust monitoring network in and above Injection Zone will provide quick detection	During Injection Period or shortly after Injection ceases

Potential CO_2 Surface Leakage Pathway	Likelihood of Occurrence	Justification of Likelihood	Magnitude	Justification of Magnitude	Timing when Pathway is a Risk
		wells in the AoR			
Existing and new wellbores constructed for the BRP Project	Low	Constructed to protect USDWs and prevent CO_2 Surface Leakage; continuous monitoring	Low	Robust monitoring network in and above Injection Zone will provide quick detection	During Injection Period or shortly after injection ceases
Faults and fractures	Low	None mapped or suspected in Injection or Upper or Lower Confining Zones	Low	Potential faults or fractures that are sub-seismic resolution would be small offset and unlikely to connect through Injection Zone	During Injection Period
Natural or induced seismicity	Low	Low historical seismicity; no faults or fractures mapped in Injection or Upper or Lower Confining Zones	Low	Potential faults or fractures that are sub-seismic resolution would be small offset and unlikely to connect through Injection Zone	During Injection Period or shortly after injection ceases
Wellheads, surface equipment, and piping	Low	Constructed with CO_2-resistant materials and monitored for corrosion; protected from surface impacts	Low	Automated system will detect leaks and execute shut-down; corroborated with in-person visual inspections	During Injection Period
Upper Confining Zone or Confining System	Low	>3000 ft thick low porosity and low permeability rock that is laterally continuous	Low	Potential capillary pathways would be extremely slow and torturous	During Injection Period
Lateral Migration beyond AoR and MMA	Low	AoR is controlled by brine withdrawal wells; the AoR position is calibrated with site-specific data	Low	Utilize a well-calibrated 3D model to forecast lateral migration; take additional operational actions to control AoR geometry, if needed	During Injection Period and shortly after injection ceases
Drilling through the AoR and MMA	Low	Drilling is regulated by the EPA, TRRC or TCEQ; no existing or suspected hydrocarbon production below AoR or MMA	Low	Potential penetrations will be constructed in accordance with EPA, TRRC, or TCEQ regulations	During Injection and Post-Injection Site Care and Site Closure Periods

Notes:
Low = Low likelihood of occurrence; or, if the event did occur it would result in little to no impact to safety, health, and the environment; and/or the quantity of resulting CO_2 Surface Leakage is expected to be small.
Moderate = Moderate likelihood of occurrence; or, if the event did occur it would result in a moderate impact to safety, health, and the environment; and/or the quantity of resulting CO_2 Surface Leakage is expected to be moderate.
High = High likelihood of occurrence; or, if the event did occur it would result in a significant impact to safety, health, and the environment; and/or the quantity of resulting CO_2 Surface Leakage is expected to be large.

6.1 Evaluation of CO_2 Surface Leakage through Wellbores

6.1.1 Legacy Artificial Penetrations in the AoR and MMA

OLVC conducted an exhaustive study including review of public and licensed well records and field surveys to identify APs in the AoR and within a half-mile radius outside of the AoR. OLCV identified a total of four legacy APs in the AoR: three plugged wells related to oil and gas operations, and one well used for USDW brine production (See the list of wells in Table 2 and Table 3). One legacy AP was identified within a half-mile radius outside of the AoR, which is entirely within the MMA.

In 2023, the brackish water producer (state well number 4511701) was plugged and abandoned by a qualified water well driller supervised by Oxy and OLCV. Although neither the CO_2 plume nor pressure front are modeled to reach the remaining three APs in the AoR within the first two years of injection, OLCV conducted corrective action in February 2025 on the three legacy APs of the AoR: Eidson E-1 (API 4213531130), Scharbauer Eidson-1 (API 4213510667) and Eidson- Scharbauer-1 (API 4213506139). Because corrective actions are completed, OLCV concludes that the risk of CO_2 Surface Leakage through legacy APs is low.

6.1.2 Evaluation of Existing and New Wellbores Constructed for the BRP Project

OLCV drilled two stratigraphic test wells that have been converted to monitoring wells, one USDW monitoring well, and one Injection Zone monitoring well inside the AoR. OLCV has also drilled three wells that comply with UIC Class VI construction standards. These three wells will serve as UIC Class VI injection wells once all required regulatory approvals are received. One additional Injection Zone monitoring well is anticipated to be drilled in the AoR within five years after the commencement of CO_2 injection. OLCV drilled four brine withdrawal wells for pressure maintenance. All wells drilled for the BRP Project are located within the MMA.

Each of the wells that penetrate the Injection Zone inside the AoR (BRP CCS1, BRP CCS2, BRP CCS3 and SLR2) is designed to be protective of USDWs and constructed with casing and cementing materials that are compatible with CO_2, site-specific subsurface conditions, and brine. Additional details on well construction for BRP CCS1, BRP CCS2 and BRP CCS3 are presented in Section 3.3 of this document. The SLR2 well has been constructed with a three-string design, similar to a UIC Class VI injection well. Casing is made of alloy steel in zones where there is low risk of CO_2 in contact with the casing. In zones where casing will be in contact with the CO_2 and formation water, the casing will be composed of corrosion resistant alloy (CRA). To ensure long term barrier integrity under anticipated CO_2 conditions at and near the Injection Zone, the cement slurry is designed to improve chemical and mechanical resistance to the effects of carbonic acid exposure.

OLCV will use multiple monitoring methodologies to confirm absence of fluid or gas leakage along wellbores. Temperature and pressure will be continuously monitored in the UIC Class VI injection wells and in Injection Zone monitoring wells to confirm mechanical integrity and the absence of leakage inside or outside of the casing. Temperature logging or other logs to confirm mechanical integrity will be conducted annually in UIC Class VI injection wells and at least once every five years in Injection Zone monitoring wells. OCLV will conduct annual saturation logging in Injection Zone monitoring wells to confirm the presence or absence of CO_2 along the wellbores.

At the surface, OLCV will monitor the geochemistry of fluids and dissolved gases in the USDW, soils and soil gases to confirm the absence of leakage of CO_2 or brine from the Injection Zone.

OLCV concludes that the risk of CO_2 Surface Leakage through new wellbores constructed for the BRP Project is low.

6.2 Evaluation of CO_2 Surface Leakage through Faults and Fractures

In November 2022, OLCV acquired high-density 3D seismic data in an area of approximately 20 square miles that encompasses the BRP Project AoR, MMA and surrounding area. Two orthogonal 2D lines totaling 10 line-miles were acquired in addition to the 3D survey. These data were used in conjunction with seismic data licensed from vendors and data from the Texas Bureau of Economic Geology to construct the structural framework. There are no known or suspected faults or fractures in the Injection Zone or penetrating the Injection and Confining Zones. The proposed Injection Zone is vertically separated from deeper faulted strata by approximately 2,500 ft, as observed on 2D and 3D seismic images, providing sufficient vertical separation to prevent any interaction between injection pressures and the faults.

OLCV concludes that the risk of CO_2 Surface Leakage through faults and fractures is low.

6.3 Evaluation of CO_2 Surface Leakage through Natural or Induced Seismicity

To evaluate the potential risk of CO_2 leakage from natural or induced seismicity. OLCV has installed five new seismometers delivering real-time seismicity alerts within the BRP Project area. In addition, two regional seismometer arrays are close to the BRP Project area: the MTX array is a private subscription array, and the TexNet array is managed by the USGS. Together, the data from the TexNet and MTX arrays provide accurate seismicity information throughout the Permian Basin. OLCV will use the existing seismometer arrays plus the new Project array to monitor events with magnitudes of 1.0 ML and greater. The combined datasets will provide appropriate coverage of seismicity events at the Project location, including the AoR and MMA, and in the surrounding area.

The BRP Project is situated in an area of West Texas that has historically exhibited low seismic activity, based on catalogs from both USGS[3] (up to and including December 2016) and TexNet[4] (January 2017 to present). The most recent recorded event of local magnitude 2 (ML 2) or greater closest to the project site occurred approximately 5 miles to the east on 22 November 2001. Seismicity approximately 25 miles North-Northeast of the Project site is attributed to saltwater disposal (SWD) in deeper formations near the basement rock and near critically stressed basement faults according to information on the TRRC website in 2022[5].

The risk to the Project from these recent seismic events is considered minimal because the proposed Injection Zone is vertically separated from deeper faulted strata by approximately 2,500ft, as observed on 2D and 3D seismic images, providing sufficient vertical separation to prevent any interaction between injection pressures and the faults. The USGS predicts this site to have low future seismic hazard. Because of these factors, there is a low risk of induced seismicity due to Project operations.

Additionally, OLCV proposes to manage Injection Zone pressure by producing brine from four brine withdrawal wells, three of which are located outside the AoR (WW1, WW3 and WW4) and one located near the northern boundary of the AoR (WW2), further reducing the risk of seismicity from the proposed Project. The WW wells will be monitored in accordance with the UIC Class VI permit, and OLCV does not expect to encounter injected CO_2 in WW1, WW3 or WW4. In the unlikely event that injected CO_2 is encountered in these wells, OLCV will take appropriate action, including shut-in of the affected well. The CO_2 stream injected into the Holt sub-zone is expected to reach the WW2 well in the future. When this occurs, the well will be plugged in the Holt sub-zone so that CO_2 injectate is not produced, and the well will continue to produce brine from the upper portion of the Lower San Andres.

OLCV concludes that the risk of CO_2 Surface Leakage resulting from induced or natural seismicity due to Project operations is low.

6.4 Evaluation of CO_2 Surface Leakage through Wellheads, Surface Equipment, and Piping

Wellheads, surface equipment, and piping present potential CO_2 Surface Leakage pathways during the operational Injection Period. Aging, corrosion, lack of maintenance, and deviation from operational parameters may cause loss of mechanical integrity. These risks are mitigated through adherence to regulatory requirements, industry standard engineering and operations practices, monitoring, and other measures. All wellheads, surface equipment, and piping within the AoR and

3 https://earthquake.usgs.gov/earthquakes/search/
4 https://www.beg.utexas.edu/texnet-cisr/texnet
5 https://www.rrc.texas.gov/oil-and-gas/applications-and-permits/injection-storage-permits/oil-and-gas-waste-disposal/injection-disposal-permit-procedures/seismicity-review/seismicity-response/

MMA were evaluated and will be monitored.

OLCV will monitor well materials during the operation period for loss of mass, thickness, cracking, pitting, and other signs of corrosion to verify that the well components continue to meet the minimum standards for material strength and performance. Materials have been selected to mitigate and inhibit corrosion. The suitability of the materials has been determined with published performance data from materials suppliers. These materials will be monitored via coupons that will be exposed to the CO_2 injectate stream. Furthermore, OLCV will conduct visual inspection of the facilities, and utilize OGI to monitor for potential CO_2 Surface Leakage that could result from potential corrosion.

External impacts to surface infrastructure such as from a truck or heavy machinery strike are unlikely to occur. The BRP Project site is in a remote area with no residences within approximately five miles of CO_2 injection wellheads. Personnel on site will be responsible for following OLCVs safety procedures. Well pads will be maintained to be free of obstructions, and wellheads will have appropriate signage and are fenced. The majority of pipeline infrastructure is buried.

OLCV concludes that the risk of CO_2 Surface Leakage through wellheads, surface equipment and piping is low.

6.5 Evaluation of CO_2 Surface Leakage through pathways in the Upper Confining Zone or Upper Confining System

The Upper San Andres and Grayburg formations are defined as the Upper Confining Zone. The Queen, Seven Rivers, Yates, Tansill, and Rustler formations are defined as the Upper Confining System. Together, the Upper Confining Zone and Upper Confining System range between approximately 3,150 – 3,360 ft thick in the AoR and MMA.

Based on well log, core, and seismic data, no CO_2 Surface Leakage pathways are identified through the Upper Confining Zone or Upper Confining System in the MMA. The data below support this conclusion:

- Site-specific data from log, whole core, and rotary sidewall core indicate the porosity of the Upper Confining Zone and Upper Confining System is 3-5% and the average permeability is <0.01 mD.

- Threshold entry pressure measurement from the Shoe Bar Ranch 1 indicates that the Upper San Andreas can hold back a column of CO_2 that is >5,000 ft thick, more than the thickness of the column anticipated to be injected for the BRP Project.

- Interpretation of recently acquired high-resolution 3D seismic data indicates that Upper San Andres and Grayburg are present and continuous throughout the AoR and MMA, and extend at least to the edge of the seismic image area, approximately 20 square miles. Seismic facies in the Upper San Andres and Grayburg are interpreted to be consistent throughout the seismic survey.

Vertical migration scenarios were tested with the dynamic simulation model. The model results will be compared with operational data collected through direct and indirect monitoring of the site during the Injection Period. Direct monitoring of the CO_2 plume and pressure front will include continuous recording of pressure and temperature in the UIC Class VI injectors and monitoring wells and routine fluid sampling from monitoring wells. The plume and pressure front will be indirectly monitored by timelapse 2D VSP and 2D surface seismic, and by DInSAR and GPS data. These data will be periodically integrated into the simulation model to conduct a history match and forecast the future extent of the AoR. The AoR may be updated in the future based on modeling results, direct and indirect measurements. If potential leakage pathways are observed within the AoR, corrective action will be taken to prevent endangerment of USDWs.

OLCV concludes that the risk of CO_2 Surface Leakage through the Confining Zone or Upper Confining System during the life of the Project is low.

6.6 Lateral Migration Beyond the AoR and MMA Leading to other Vertical Pathways

OLCV constructed a geocellular model that was dynamically simulated to represent the BRP Project subsurface characteristics and operational plans. The model has been calibrated with site-specific seismic data and log, core, fluid, pressure and geomechanical data from Project wells. The model will be history-matched to brine withdrawal and CO_2 injection data after operations commence. Furthermore, geochemical data, time-lapse and seismic, and DInSAR and GPS data will provide additional points of calibration. Together, these data sources are expected to allow OLCV to interpret the past geometry of the CO_2 plume and pressure front and forecast the future geometry.

OLCV will control the lateral position of the CO_2 plume and pressure front through wells that withdraw brine from the Injection Zone. The brine will be utilized for other operations or will be disposed. OLCV will use operational data and model predictions to determine the position of the CO_2 plume and pressure front. OLCV will adjust the AoR, as needed, in accordance with UIC Class VI rules. OLCV will adjust the MMA, if needed, in accordance with 40 CFR §98.440-449. OLCV will take additional operational action to control the geometry of the AoR, if needed, to avoid migration to undesired acreage that may provide vertical migration pathways.

OLCV concludes that the risk of CO_2 Surface Leakage resulting from lateral migration beyond the MMA is low.

6.7 Drilling Through the AoR and MMA

There has been no historic hydrocarbon production from formations below the Lower San Andres Formation within the MMA. There is little chance of another operator unexpectedly drilling into the MMA, because the Texas Railroad Commission (TRRC) and Texas Commission on Environmental Quality (TCEQ) regulate all drilling activity in Texas except for UIC Class VI wells (Texas has applied to the EPA for primacy over UIC Class VI injection wells). Both agencies require applications and approvals before a well is drilled, recompleted, or re-entered and impose rigorous construction and operation requirements to isolate USDWs and minerals. Additionally, OLCV will be vigilant for any potential drilling operations in or near the AoR and MMA and may take such actions as appropriate to prevent any drilling though the AoR and MMA. Consequently, the risks associated with third parties drilling through the CO_2 area are negligible.

OLCV concludes that the risk of CO_2 Surface Leakage due to unexpected drilling by another operator during the life of the Project is low.

7.0 MONITORING, DETECTION, QUANTIFICATION STRATEGY

Pursuant to 40 CFR 98.448(a)(3), OLCV has developed a strategy for detecting and quantifying any CO_2 Surface Leakage. The strategy is based on establishing expected baselines, pursuant to 40 CFR 98.448(a)(4), and implementing a testing and monitoring plan designed to address potential CO_2 Surface Leakage pathways identified, pursuant to 40 CFR 98.448(a)(2).

7.1 Testing and Monitoring Methods for Detecting Potential CO_2 Surface Leakage

The following table summarizes the testing and monitoring methods deployed at the BRP Project.

Table 6—Testing and Monitoring Methods to Confirm Absence of CO_2 Surface Leakage.

Potential CO_2 Surface Leakage Pathway	Testing and Monitoring Methods to Confirm Absence of CO_2 Surface Leakage
Legacy APs in the MMA	Geochemical analysis of soil gas monitors installed throughout the Project site
	Geochemical analysis of fluids and dissolved gases in the USDW
	Pressure and temperature monitoring of wells monitoring the Confining Zone using gauges or Distributed Temperature Sensing (DTS) fiber
	DInSAR data and GPS to measure small-scale surface displacement
Existing and new wellbores constructed for the BRP Project	Pressure and temperature monitoring of Injection wells using downhole and surface gauges and/or DTS fiber (temperature)
	Rate and volume of CO_2 injectate stream entering UIC Class VI injection wells
	Geochemical analysis of CO_2 injectate stream
	Geochemical analysis of fluids and dissolved gases encountered by wells monitoring the Injection Zone
	Mechanical Integrity Testing of UIC Class VI injection wells
	Mechanical Integrity Testing of wells monitoring the Injection Zone and brine withdrawal wells
	Corrosion coupon analysis of well construction materials in UIC Class VI injection wells
	Corrosion coupon analysis of well construction materials in Injection Zone monitoring wells
	Corrosion analysis using casing inspection logging in Injection Zone monitoring wells
	Corrosion coupon analysis of well construction materials in Confining Zone monitoring wells

Potential CO_2 Surface Leakage Pathway	Testing and Monitoring Methods to Confirm Absence of CO_2 Surface Leakage
	Surface visual inspections and surface OGI
	Saturation logging in wells monitoring the Injection Zone
	Saturation logging in wells monitoring the Confining zone
	Saturation logging in brine withdrawal wells
Faults and fractures	Geochemical analysis of soil gas
	Geochemical analysis of fluids and dissolved gases in the USDW
	Pressure and temperature monitoring of wells monitoring the Confining Zone using gauges or DTS fiber (temperature)
	DInSAR data and GPS to measure small-scale surface displacement
	Pressure and temperature monitoring of UIC Class VI injection wells using downhole and surface gauges and/or DTS fiber (temperature)
	Pressure and temperature of wells monitoring the Injection Zone using downhole and surface gauges and/or DTS fiber (temperature)
Natural or induced seismicity	Seismicity recorded at site-specific seismometers
Wellheads, surface equipment, and piping	Corrosion coupon analysis of well construction materials in UIC Class VI injection wells
	Surface visual inspections and surface OGI
	Pressure and temperature of wells monitoring the Injection Zone using downhole and surface gauges and/or DTS fiber (temperature)
	Pressure and temperature monitoring of UIC Class VI injection wells using downhole and surface gauges and/or DTS fiber (temperature)
	Rate and volume of CO_2 injectate stream entering UIC Class VI injection wells
	Geochemical analysis of CO_2 injectate stream
Upper Confining Zone or Confining System	Geochemical analysis of fluids and gases in the USDW
	Geochemical analysis of soil gas
	Pressure and temperature monitoring of wells monitoring the Confining Zone using gauges or DTS fiber (temperature)
	Saturation logging in wells monitoring the Confining Zone
	Pressure and temperature of wells monitoring the Injection Zone using downhole and surface gauges and/or DTS fiber (temperature)
	2D VSP timelapse seismic methods for CO_2 plume and pressure front interpretation
	2D surface timelapse seismic methods for CO_2 plume and pressure front interpretation
	3D dynamic modelling, calibration, and history matching
	Pressure fall-off testing to evaluate near well-bore properties in UIC Class VI injection wells
Lateral Migration Outside of MMA	DInSAR data and GPS to measure small-scale surface displacement
	Geochemical analysis of soil gas
	3D dynamic modelling, calibration, and history matching
	Geochemical analysis of fluid and gases produced by brine withdrawal wells
	Pressure and temperature monitoring of brine withdrawal wells using downhole and surface gauges
Drilling Through the MMA	Monitoring of permits and rig activity near the BRP Project site

7.1.1 Geochemical Testing and Monitoring of Fluids and Dissolved Gases

Fluids and dissolved gases were sampled in the Injection Zone and the USDW during well construction. The samples were analyzed for geochemical and isotopic composition. A further baseline dataset is being developed by sampling fluids and dissolved gases in the Injection Zone and USDW approximately quarterly for a period of approximately one year prior to the commencement of CO_2 injection.

Quarterly sampling and analysis of fluids and dissolved gases in the USDW is planned to continue for the first three years after the commencement of CO_2 injection operations and thereafter transition to annual sampling, unless other data indicates the potential for fluids from the Injection Zone migrating above the Confining Zone. Data that could increase the frequency of soil gas sampling could include anomalous pressure or temperature data in the Confining Zone, changes detected with saturation logging of the Confining Zone, or anomalous geochemical or isotopic changes in the soil gas. During the PISC period, fluid and dissolved gas samples from the USDW will be collected and analyzed on an annual basis for 10 years, or more frequently if other data, as described above, are consistent with possible movement of Injection Zone fluids above the Confining Zone.

Fluids and dissolved gases in the Injection Zone will be sampled and analyzed if other data indicate that the composition of fluids in the Injection Zone has changed at the location of an Injection Zone monitoring well. Data that could trigger sampling in the Injection Zone could include anomalous pressure or temperature data, or changes detected through saturation logging.

Note that there are no permeable zones interpreted between the USDW and the Confining Zone at the BRP Project AoR. The locations and frequency of fluid and dissolved gas sampling in the Injection Zone and the USDW established for the BRP Project will provide an indication of the presence or absence of potential CO_2 Surface Leakage.

7.1.2 CO_2 Injectate Stream Monitoring

Prior to commencement of CO_2 injection operations, OLCV will sample and analyze the chemical and isotopic composition of the CO_2 injectate stream. OLCV will monitor the chemistry of the CO_2 injectate stream using gas chromatography and online gas analyzers near the custody transfer meter to confirm that the injectate stream meets the specifications outlined in the UIC Class VI permit. The field methods will be confirmed by laboratory analysis on a quarterly basis, or more frequently if required by material changes in the DAC process.

The locations of sampling devices and the frequency of sampling the CO_2 injectate stream will identify potential chemical changes that could contribute to corrosion and potentially lead to CO_2 Surface Leakage.

7.1.3 Continuous Monitoring of Operational Parameters

OLCV will install and use continuous recording devices in UIC Class VI wells to monitor injection pressure, rate, and volume; the pressure on the annulus between the tubing and the long string casing; and the temperature of the CO_2 stream, as required by 40 CFR §146.88(e)(1), §146.89(b), and §146.90(b). Injection operations will be continuously monitored, controlled, and recorded by the operations staff utilizing a process control system that will be alarmed for critical system parameters of pressure, temperature, and injection flow rate. The system will initiate a shutdown of the UIC Class VI well if specified control parameters deviate by established thresholds from the intended operating range and will allow for remote shutdown under emergency conditions. Trend analysis will aid in evaluating the performance (e.g., drift) of the instruments, indicating the need for maintenance or calibration.

OLCV will monitor and measure injection pressure and temperature (P/T) three ways in the UIC Class VI wells, Injection Zone Monitoring wells and Confining Zone monitoring wells: downhole gauges, surface gauges, and Distributed Temperature Sensing (DTS) fiber (temperature only). These devices will allow BRP Project personnel to confirm that the wells are being operated as intended and will aid in the identification of potential corrosion or potential loss of mechanical integrity in the wellbores.

7.1.4 Internal and External Mechanical Integrity Testing

OLCV will conduct tests to verify the internal and external mechanical integrity of the UIC Class VI wells before and during the Injection Period pursuant to 40 CFR §146.89(c), 40 CFR §146.90(e), 40 CFR §146.87 (a)(2)(ii), and 40 CFR §146.87 (a)(3)(ii). OLCV will also conduct tests to monitor internal and external mechanical integrity of Injection Zone monitoring wells, Confining Zone monitoring wells, and brine withdrawal wells.

The purpose of internal mechanical integrity testing is to confirm the absence of significant CO_2 or brine leakage within the injection tubing, casing, or packers (40 CFR §146.89(a)(1)). Continuous monitoring of injection pressure, injection rate, injected volume and annulus pressure will be used to verify internal mechanical integrity. In addition, annulus pressure tests will be periodically conducted to confirm gauge measurements.

The purpose of external mechanical integrity testing is to confirm the absence of significant CO_2 or brine leakage outside of the casing (40 CFR §146.89(a)(2)). OLCV will conduct temperature logging in the UIC Class VI injector wells on an annual basis to demonstrate external mechanical integrity. OLCV will conduct temperature logs or other logs to demonstrate mechanical integrity at least once every five-year period in Injection Zone monitoring wells and Confining Zone monitoring wells. In addition, OLCV plans to collect continuous temperature profiles above the Injection Zone in the UIC Class VI wells and in selected monitoring wells using DTS fiber.

The multiple mechanical integrity monitoring methods noted above will identify any potential decrease in mechanical integrity that could potentially lead to CO_2 Surface Leakage.

7.1.5 Corrosion Monitoring of Well and Piping Construction Materials

To meet the requirements of 40 CFR §146.90(c), OLCV will monitor well materials during the operation period for loss of mass, thickness, cracking, pitting, and other signs of corrosion to verify that the well components continue to meet the minimum standards for material strength and performance.

Well and piping materials have been selected to mitigate the risk of, and inhibit, corrosion. These materials will be monitored via coupons that will be exposed to the CO_2 injectate stream and reservoir fluids. Corrosion monitoring of the UIC Class VI wells, Injection Zone monitoring wells, Confining Zone monitoring wells, and brine withdrawal wells will be conducted in a surface monitoring spool located near the wellhead that contains multiple access points.

In addition to coupons, OLCV will conduct visual inspection of the facilities, utilize OGI, and evaluate data from DTS to monitor for potential CO_2 or brine leakage that could result from corrosion.

The multiple corrosion monitoring methods will identify any potential corrosion that could result in a decrease in mechanical integrity and potentially lead to CO_2 Surface Leakage.

7.1.6 Soil and Soil Gas Monitoring

Permanent subsurface soil gas probes will be installed at 20 representative locations throughout the AoR and adjacent area. Soil gas characterization and monitoring will be used in concert with fluid analyses to conduct a process-based approach according to the principles described in Romanak (2012). Soil gas data will aid in the identification, characterization, and source-attribution of CO_2 encountered in the near-surface. However, the evaluation of near-surface data is complicated by the variations in natural processes in the vadose zone (e.g., root respiration, biologic respiration, microbial oxidation of methane), anthropogenic sources unrelated to the BRP Project (e.g., nearby oil and gas production), gases from deeper zones (e.g., shallow groundwater), and atmospheric exchanges driven by barometric differences, which can be seasonal (NETL, 2017).

If a departure from baseline/seasonal parameter patterns is observed, additional testing of soil gas, the atmosphere, and/or the fluids in the Injection Zone or USDW may be conducted. These data will be integrated with seismic, DInSAR and other data to attribute the source of anomalous soil gas data. OLCV is confident that soil gas, coupled with other measurements, will aid in detection of CO_2 Surface Leakage.

7.1.7 DInSAR and GPS Monitoring

OLCV will monitor the BRP Project AoR using indirect methods pursuant to 40 CFR §146.90(g)(2). The BRP Project plans to use DInSAR and GPS data to indirectly monitor the position of the CO_2 pressure plume. DInSAR is a non-intrusive, non-destructive technology that measures, with high accuracy, relative displacement over time. It is highly effective for measuring sub-millimeter ground deformation over multiple years. A network of 11 corner reflectors is installed to serve as permanent monuments for GPS data collection and to aid in satellite data processing repeatability. Prior to CO_2 injection, a historical evaluation of past ground movement will be conducted. Data acquisition and interpretation will be repeated on a quarterly basis during the Injection Period and annually for 10 years of the PISC.

DInSAR, coupled with GPS data, is expected to provide information on the surface impact of subsidence or uplift induced by subsurface operations at the BRP Project. OLCV is confident that this information will aid in calibration of geomechanical models, the dynamic simulation model, and detection of potential CO_2 Surface Leakage pathways.

7.1.8 Timelapse seismic monitoring

OLCV will monitor the CO_2 plume and pressure front of the BRP Project using indirect methods pursuant to 40 CFR §146.90(g)(2). OLCV integrated the results of the 2D and 3D seismic with rock and fluid properties measured in the Shoe Bar Ranch 1 and Shoe Bar Ranch 1AZ to screen for detectability of a geophysical response resulting from a change in fluid or pressure in the Injection Zone. This screening result demonstrates the subtlety of time-lapse changes to sonic and density logs in the Injection Zone. The detectability of a change in fluid or pressure is improved by utilizing wellbore seismic methods, therefore OLCV intends to acquire seismic using a VSP in selected wellbores. Modeling conducted by OLCV indicates that 2D VSP is an appropriate seismic method.

The imaging area of a VSP is limited to approximately 3,500 – 3,800 feet away from the wellbore, based on modeling conducted by OLCV and a third-party contractor. To image the full extent of the AoR, OLCV proposes to acquire 2D surface seismic in a radial pattern centered near the surface location of the UIC Class VI wellheads. For surface methods, the detectability of a time-lapse response resulting from a change in fluid or pressure improves with higher concentrations of CO_2. Therefore, surface seismic will be used as a monitoring technique in the later part of the Injection Period and in the PISC.

2D VSP and 2D surface seismic are expected to provide information on the geometry of the CO_2 plume and pressure front. This information will aid in calibration of the dynamic simulation model and detection of potential CO_2 Surface Leakage pathways.

7.1.9 Seismicity Monitoring

While the historical seismicity of the project area indicates no earthquakes in the immediate vicinity, OLCV intends to monitor the site with a seismic monitoring system for the duration of the BRP Project to ensure the safe operation of both the storage facility and adjacent infrastructure in the area. The seismic monitoring will be conducted with a surface array deployed to ensure detection of events above local magnitude level (ML) 1.0, with epicentral locations within 10 miles of the UIC Class VI wells.

OLCV has installed five new seismometers at the BRP Project site to deliver real-time seismicity alerts within the BRP Project area. These data will be integrated with data from the USGS seismometer network, called TexNet, and the MTX private subscription array.

OLCV will implement a response plan to be protective of USDW based on event magnitude and epicentral location. The response plan is triggered if an event above ML 2.0 occurs within 5.6 miles of the UIC Class VI injector wells. In the unlikely outcome that a seismic event results in CO_2 Surface Leakage, OLCV will quantify and report the leakage.

7.2 Testing and Monitoring Plan to Detect CO_2 Surface Leakage

The testing and monitoring methods in Table 7 address the potential CO_2 Surface Leakage pathways described in Section 6.0 of this document. Testing and monitoring for detecting CO_2 Surface Leakage are consistent with the Testing and Monitoring Plan developed for UIC Class VI permits. OLCV will employ mitigations and controls to prevent CO_2 or brine leakage out of the Injection Zone that could endanger the USDWs, migrate to different stratum, or create a risk for people or the environment. The Testing and Monitoring Plan is tailored to track the migration of the CO_2 plume and development of the pressure front within the Injection Zone. Data will be collected prior to CO_2 injection to establish a baseline. Data collected during the Injection Period and PISC from the testing and monitoring program will help to validate the simulation models and re-evaluate the AoR. In addition, OLCV will collect mass balance data to monitor the amount of CO_2 injected and sequestered through the BRP Project.

Table 7—Summary of testing and monitoring methods, scope, and timing, to address potential CO_2 Surface Leakage pathways.

Potential CO_2 Surface Leakage Pathway	Testing and Monitoring Methods to Confirm Absence of CO_2 Surface Leakage	Tested prior to Injection Period to Establish a Baseline	Frequency During Injection Period	Frequency During Post-Injection and Site Care Period (PISC)
Legacy APs in the MMA	Geochemical analysis of soil gas monitors installed	Before injection	Quarterly gas composition sampling in years 1-3 and annually starting in year 4	Event-driven* sampling, triggered by

Potential CO_2 Surface Leakage Pathway	Testing and Monitoring Methods to Confirm Absence of CO_2 Surface Leakage	Tested prior to Injection Period to Establish a Baseline	Frequency During Injection Period	Frequency During Post-Injection and Site Care Period (PISC)
	throughout the Project site		for subset of stations, and event-driven* sampling, triggered by pressure/temperature data from monitor wells or fluid sample results	pressure/temperature data from monitor wells or fluid sample results
	Geochemical analysis of fluids and dissolved gases in the USDW	Before injection	Quarterly sampling in years 1-3 and annually starting in year 4; and, event-driven* sampling, triggered by pressure/temperature data from Injection Zone monitoring wells	Annually for first 10 years post injection; and, event-driven* sampling, triggered by pressure/temperature data in Injection Zone monitoring wells
	Pressure and temperature monitoring of wells monitoring the Confining Zone gauges or DTS	Before injection	Continuous measurement and recording of pressure and temperature	Continuously for the first 10 years or until plugging
	DInSAR data and GPS to measure small-scale surface displacement	Before injection	Quarterly data acquisition	Annual data acquisition for five years or until plume stabilization
Existing and new wellbores constructed for the BRP Project	Pressure and temperature monitoring of UIC Class VI injection wells using downhole and surface gauges and/or DTS (temperature)	Before injection	Continuous measurement and recording	Not applicable
	Rate and volume of CO_2 injectate stream entering UIC Class VI injection wells	Not applicable	Continuous measurement and recording	Not applicable
	Geochemical analysis of CO_2 injectate stream	Before injection	Continuous monitoring using gas analyzers; quarterly and event-driven* sampling for	Not applicable

Potential CO_2 Surface Leakage Pathway	Testing and Monitoring Methods to Confirm Absence of CO_2 Surface Leakage	Tested prior to Injection Period to Establish a Baseline	Frequency During Injection Period	Frequency During Post-Injection and Site Care Period (PISC)
			composition; and isotopic analysis if capture process materially changes source stream	
	Geochemical analysis of fluids and dissolved gases encountered by wells monitoring the Injection Zone	Before injection	Event-driven* sampling, triggered by changes in pressure, temperature, or observations of saturation logging	Event-driven* sampling until plugging, triggered by changes in pressure, temperature, or observations of saturation logging
	Mechanical Integrity Testing of UIC Class VI injection wells	Before injection	Annular pressure test at least once every five-year period following well intervention events and before plugging; Annual temperature logging; continuous pressure/temperature monitoring	Not applicable
	Mechanical Integrity Testing of wells monitoring the Injection Zone and brine withdrawal wells	Before injection	Annular pressure test at least once every five-year period following well intervention events and before plugging; continuous pressure/temperature monitoring; mechanical integrity logging at least once every five-year period	Annular pressure test at least once every five-year period following well intervention events and before plugging; mechanical integrity logging at least once every five-year period and before plugging
	Corrosion coupon analysis of well construction materials in UIC Class VI injection wells	Not applicable	Quarterly coupon testing	Not applicable
	Corrosion coupon analysis of well construction materials in Injection Zone monitoring wells	Not applicable	Quarterly coupon testing	Quarterly coupon testing until plugging

Potential CO_2 Surface Leakage Pathway	**Testing and Monitoring Methods to Confirm Absence of CO_2 Surface Leakage**	**Tested prior to Injection Period to Establish a Baseline**	**Frequency During Injection Period**	**Frequency During Post-Injection and Site Care Period (PISC)**
	Corrosion analysis using casing inspection logging in Injection Zone monitoring wells	Not applicable	During planned well maintenance	Not applicable
	Corrosion coupon analysis of well construction materials in Confining Zone monitoring wells	Not applicable	Quarterly coupon testing	Quarterly coupon testing until plugging
	Surface visual inspections and surface OGI	Not applicable	Weekly visual inspection, quarterly inspection via OGI	Quarterly visual inspection until site closure
	Saturation logging in wells monitoring the Injection Zone	Before injection	Annual logging	Annual logging until plugging
	Saturation logging in wells monitoring the Confining zone	Before injection	Logging once every five-year period or event-driven* logging	Event-driven* logging
	Saturation logging in brine withdrawal wells	Before injection	Logging once every five-year period or event-driven* logging	Not applicable
Faults and fractures	Geochemical analysis of soil gas	Before injection	Quarterly gas composition sampling in years 1-3 and annually starting in year 4 for subset of stations, and event-driven* sampling, triggered by pressure/temperature data from monitor wells or fluid sample results	Event-driven* sampling, triggered by pressure/temperature data from monitor wells or fluid sample results
	Geochemical analysis of fluids and dissolved gases in the USDW	Before injection	Quarterly sampling in years 1-3 and annually starting in year 4; and, event-driven* sampling, triggered by pressure/temperature data from Injection Zone monitoring wells	Annually for first 10 years post injection; and, event-driven* sampling, triggered by pressure/temperature data in Injection Zone monitoring wells
	Pressure and temperature	Before injection	Continuous measurement and recording of pressure	Continuously for the first 10 years or until

Potential CO_2 Surface Leakage Pathway	Testing and Monitoring Methods to Confirm Absence of CO_2 Surface Leakage	Tested prior to Injection Period to Establish a Baseline	Frequency During Injection Period	Frequency During Post-Injection and Site Care Period (PISC)
	monitoring of wells monitoring the Confining Zone gauges or DTS (temperature)		and temperature	plugging
	DInSAR data and GPS to measure small-scale surface displacement	Before injection	Quarterly data acquisition	Annual data acquisition for five years or until plume stabilization
	Pressure and temperature monitoring of UIC Class VI injection wells using downhole and surface gauges and/or DTS (temperature)	Before injection	Continuous measurement and recording	Not applicable
	Pressure and temperature of wells monitoring the Injection Zone using downhole and surface gauges and/or DTS fiber (temperature)	Before injection	Continuous measurement and recording of pressure and temperature	Continuous measurement and recording for the first 10 years pending an approved PISC plan, then annually until plugging
Natural or induced seismicity	Seismicity recorded at site-specific seismometers	Before injection	Continuous monitoring and recording	Continuous monitoring and recording until site closure
Wellheads, surface equipment, and piping	Corrosion coupon analysis of well construction materials in UIC Class VI injection wells	Not applicable	Quarterly coupon testing	Not applicable
	Surface visual inspections and surface OGI	Not applicable	Weekly visual inspection, quarterly inspection via OGI	Quarterly visual inspection until site closure
	Pressure and temperature of wells monitoring the Injection Zone	Before injection	Continuous measurement and recording of pressure and temperature	Continuous measurement and recording for the first 10 years

Potential CO_2 Surface Leakage Pathway	**Testing and Monitoring Methods to Confirm Absence of CO_2 Surface Leakage**	**Tested prior to Injection Period to Establish a Baseline**	**Frequency During Injection Period**	**Frequency During Post-Injection and Site Care Period (PISC)**
	using downhole and surface gauges and/or DTS fiber (temperature)			pending an approved PISC plan, then annually until plugging
	Pressure and temperature monitoring of UIC Class VI injection wells using downhole and surface gauges and/or DTS (temperature)	Before injection	Continuous measurement and recording	Not applicable
	Rate and volume of CO_2 injectate stream entering UIC Class VI injection wells	Not applicable	Continuous measurement and recording	Not applicable
	Geochemical analysis of CO_2 injectate stream	Before injection	Continuous monitoring using gas analyzers; quarterly and event-driven* sampling for composition; and isotopic analysis if capture process materially changes source stream	Not applicable
Upper Confining Zone or Confining System	Geochemical analysis of fluids and dissolved gases in the USDW	Before injection	Quarterly sampling in years 1-3 and annually starting in year 4; and, event-driven* sampling, triggered by pressure/temperature data from Injection Zone monitoring wells	Annually for first 10 years post injection; and, event-driven* sampling, triggered by pressure/temperature data in Injection Zone monitoring wells
	Geochemical analysis of soil gas	Before injection	Quarterly gas composition sampling in years 1-3 and annually starting in year 4 for subset of stations, and event-driven* sampling, triggered by pressure/temperature data from monitor wells or fluid sample results	Event-driven* sampling, triggered by pressure/temperature data from monitor wells or fluid sample results

Potential CO_2 Surface Leakage Pathway	Testing and Monitoring Methods to Confirm Absence of CO_2 Surface Leakage	Tested prior to Injection Period to Establish a Baseline	Frequency During Injection Period	Frequency During Post-Injection and Site Care Period (PISC)
	Pressure and temperature monitoring of wells monitoring the Confining Zone gauges or DTS (temperature)	Before injection	Continuous measurement and recording of pressure and temperature	Continuously for the first 10 years or until plugging
	Saturation logging in wells monitoring the Confining zone	Before injection	Logging once every five-year period or event-driven* logging	Event-driven* logging
	Pressure and temperature of wells monitoring the Injection Zone using downhole and surface gauges and/or DTS fiber (temperature)	Before injection	Continuous measurement and recording of pressure and temperature	Continuous measurement and recording for the first 10 years pending an approved PISC plan, then annually until plugging;
	2D VSP timelapse seismic methods for CO_2 plume and pressure front interpretation	Before injection	Acquisition at 1, 2, 5 and 10 years post commencement of CO_2 injection	Acquisition approximately once during every five-year period until well plugging
	2D surface timelapse seismic methods for CO_2 plume and pressure front interpretation	Before injection	Acquisition at 10 years post commencement of CO_2 injection and approximately every five years thereafter	Acquisition approximately once during every five-year period until plume stabilization
	3D dynamic modelling, calibration, and history matching	Before injection	As needed, to be used for AoR re-evaluation	As needed, to be used for AoR re-evaluation
	Pressure fall-off testing to evaluate near well-bore properties in UIC Class VI injection wells	Before injection	Testing once during every five-year period until plugging	Not applicable
Lateral Migration outside of MMA	DInSAR data and GPS to measure small-scale surface displacement	Before injection	Quarterly data acquisition	Annual data acquisition for five years or until plume stabilization
	Geochemical	Before injection	Quarterly gas composition	Event-driven*

Potential CO_2 Surface Leakage Pathway	Testing and Monitoring Methods to Confirm Absence of CO_2 Surface Leakage	Tested prior to Injection Period to Establish a Baseline	Frequency During Injection Period	Frequency During Post-Injection and Site Care Period (PISC)
	analysis of soil gas		sampling in years 1-3 and annually starting in year 4 for subset of stations, and event-driven* sampling, triggered by pressure/temperature data from monitor wells or fluid sample results	sampling, triggered by pressure/temperature data from monitor wells or fluid sample results
	3D dynamic modelling, calibration, and history matching	Before injection	As needed, to be used for AoR re-evaluation	As needed, to be used for AoR re-evaluation
	Geochemical analysis of fluid and dissolved gases produced by brine withdrawal wells	Before injection	Event-driven* sampling, triggered by changes in pressure, temperature, or observations of saturation logging	Not applicable
	Pressure and temperature monitoring of brine withdrawal wells using downhole and surface gauges	Before injection	Continuous measurement and recording	Not applicable
Drilling through the MMA	Monitoring of permits and rig activity near the BRP Project site	Before injection	Quarterly	Annually, until plume stabilization

*Event-driven means that sampling using a particular method will be triggered by the interpretation of data from another method. For example, event-driven sampling of the CO_2 injectate stream will be triggered if there are changes in the DAC process that may arise from facility upgrades or after facility shut-in periods. Or, for example, if saturation logging is interpreted to indicate a change in the fluid composition encountered by the wellbore, it may trigger substantiation with geochemical data.

OLCV will monitor pressure and temperature data obtained from downhole gauges and/or DTS fiber daily, and routinely evaluate long-term data trends to detect deviations from the reference temperature or pressure gradient. If persistent deviations in temperature or pressure are detected, OLCV will obtain reservoir fluid samples and analyze fluid and dissolved gas chemistry to determine the presence or absence of increased CO_2. In addition, fluid, and dissolved gas chemistry data from the lowermost USDW and soil gas chemistry from shallow soils will be monitored for trends to detect deviations from reference chemistry. If persistent and/or abrupt anomalies in chemistry are detected additional fluid or soil gas samples will be obtained to confirm the presence or absence of increased CO_2.

7.3 Establishing Baselines for Monitoring Potential CO_2 Surface Leakage

Pursuant to 40 CFR 98.448(a)(4), OLCV has conducted baseline testing to characterize the following components of the Project site:

- Geochemical and isotopic properties of fluids and dissolved gases in the Injection Zone and the first permeable zone above the Confining Zone, which is coincident with the USDW for this Project
- Geochemical and isotopic properties of soils and soil gases in the near-surface
- Geochemical and isotopic properties of the CO_2 injectate stream
- Pressure and temperature of the Injection Zone, and Upper and Lower Confining Zones
- Geologic and geomechanical properties of rocks and fluids in the Injection Zone, Upper and Lower Confining Zone, Upper Confining System, and USDW
- Mechanical integrity of wellbores and piping construction materials
- Site-specific seismicity
- Geometry of the Earth's surface at the Project site
- Geophysical properties and subsurface imaging from near the Earth's surface to the geologic basement
- Locations, status, and mechanical integrity of legacy APs in the AoR and near the AoR

These data were used to develop operational plans for CO_2 injection rate and volume for safe and secure long-term storage of CO_2 at the Project site. In addition, these data were used to build a 3D geocelluar model and a dynamic simulation model. The results of the modelling work were used to define the AoR and determine the timing of CO_2 plume and pressure stabilization.

Table 8—Baseline data collection.

Baseline data	Baseline Data Locations	Description of Data Collection
Geochemical and isotopic properties of fluids and dissolved gases in the Injection Zone	Samples obtained during construction of 10 wells; repeat samples obtained at five wells	Sampling and analysis during well construction and quarterly for approximately one year prior to CO_2 injection, contingent upon length of time between well construction and CO_2 injection start-up
Geochemical and isotopic properties of fluids and dissolved gases in the USDW, which is coincident with the first permeable zone above the Confining Zone for this Project	Samples obtained in one USDW monitoring well	Sampling and analysis during well construction and quarterly for approximately one year prior to CO_2 injection, contingent upon length of time between well construction and CO_2 injection start-up
Geochemical and isotopic properties of soils and soil gases in the near-surface	20 stations spread throughout the AoR and surrounding the AoR	Soil sampling and analyses during station construction; soil gas sampling and analysis conducted quarterly for approximately one year

Baseline data	Baseline Data Locations	Description of Data Collection
		prior to start of CO_2 injection
Geochemical and isotopic properties of the CO_2 injectate stream	Gas analyzers located at the Stratos facility	During Stratos facility commissioning phase
	Gas analyzers located near the CO_2 custody transfer meter	Prior to accepting custody of CO_2 in the pipeline
Pressure and temperature of the Injection Zone, and Upper Confining Zone	Measurements in 10 wells	Measurements conducted during well construction and continuously once pressure gauges are installed and/or DTS interrogators are operational
Pressure and temperature of the Lower Confining Zone	Measurements in two stratigraphic test wells	Measurements conducted during well construction
Geologic and geomechanical properties of rocks and fluids in the Injection Zone, Upper and Lower Confining Zone, Upper Confining System, and USDW	Logs in 10 wells and core in three wells	Logs and/or core acquired during well construction
Mechanical integrity of wellbores and piping construction materials	MIT testing	MIT annular testing and/or logging acquired during well construction
Site-specific seismicity	Five site-specific seismometers, plus regional seismometer network data subscriptions	Seismometers installed and continuously monitored for approximately one year prior to start of CO_2 injection
Geometry of the Earth's surface at the Project site	DInSAR and GPS data acquired	Data recorded quarterly for approximately one year prior to start of CO_2 injection
Geophysical properties and subsurface imaging from near the Earth's surface to the geologic basement	Project site	20 mi^2 3D survey and two 2D lines acquired over the Project area in 2022, 2D VSPs and 2D seismic acquired at selected wells prior to the start of CO_2 injection
Locations, status, and mechanical integrity of legacy APs in the AoR and near the AoR	Project site	Public and private records search; and field surveys to identify and confirm the presence of wellbores

7.4 CO_2 Surface Leakage Quantification

Given the uncertainty concerning the nature and characteristics of any unanticipated Surface Leakage that may occur, OLCV will determine the most appropriate method to quantify the volume of CO_2 using a case-by-case basis to assess, address, track, and (if applicable) quantify any potential CO_2 Surface Leakage. In the event CO_2 Surface Leakage is confirmed, the most appropriate methods for quantifying the mass of CO_2 Surface Leakage will be determined, and the information will be reported as part of the required annual Subpart RR submission (or as otherwise may be required). The duration of the confirmed CO_2 Surface Leakage may be determined by comparing the time the CO_2 Surface Leakage is detected with the last time the site and equipment was determined to have mechanical integrity, or by such other method as may be allowed and appropriate under the circumstances of the identified CO_2 Surface Leakage. The potential quantification methods for quantity (mass) may include, but are not limited to:

- For CO_2 leakage from surface equipment and pipelines, OLCV will follow 40 CFR 98.444(d); and, the injection rate and surface temperature and pressure monitoring data may provide a basis to estimate the duration and amount of CO_2 loss;
- For subsurface CO_2 leakage through wellbores, the injection rate and downhole temperature and pressure monitoring data may provide the basis to determine duration and the amount of CO_2 loss;
- For CO_2 leakage related to the competency of the Upper Confining Zone or Upper Confining System, reservoir modeling and engineering estimates may provide the basis for determining the amount of CO_2 loss.

OLCV will include a statistical estimate of the calculation error to document the likely range of the CO_2 Surface Leakage quantity for each quantification method.

8.0 SITE SPECIFIC CONSIDERATIONS FOR CALCULATING MASS BALANCE EQUATIONS

8.1 General Monitoring Procedures

Existing operations will be centrally and continuously monitored and controlled using a Supervisory Control and Data Acquisition (SCADA) software system. Flow rates, pressures, gas composition, and other data will be collected at key points and stored in a centralized data management system. These data are monitored 24 hours a day by qualified technicians who follow response and reporting protocols when the system delivers notifications that data exceed predetermined statistically acceptable limits. All meter and composition data will be recorded and stored in accordance with applicable regulations and Section 13, below. Metering protocols follow the prevailing industry standard(s) for custody transfer as currently promulgated by the American Petroleum Institute (API; API MPMS Chapter 14.9) and the American Gas Association (AGA; AGA Report No. 11) or comparable standards developed in the future.

8.2 CO_2 Received

OLCV will continuously measure the mass of CO_2 received by the BRP Project. A Coriolis meter and gas analyzers are located at M1 on Figure 6.

8.3 CO_2 Injected into the Subsurface

OCLV will continuously measure the mass of CO_2 injected for sequestration. A Coriolis meter and gas analyzers are located at M1 on Figure 6.

8.4 CO_2 Produced, Entrained in Products, and Recycled

No injected CO_2 will be produced or entrained in products or recycled.

8.5 CO_2 Emitted by Surface Leakage

40 CFR 98.230-238 (Subpart W) is used to estimate CO_2 emissions from equipment, such as gas analyzers. In addition, an event-driven process will be used to assess, address, track, and if applicable, quantify potential CO_2 Surface Leakage as described in Section 7.4.

9.0 DETERMINATION OF SEQUESTRATION VOLUMES USING MASS BALANCE EQUATIONS

Figure 6 is a representative process flow diagram showing the location of the Coriolis meter and gas analyzers for the mass balance calculations.

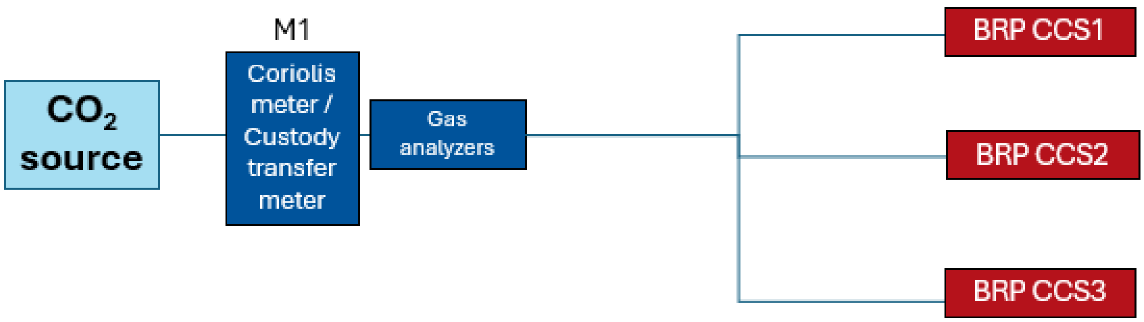

Figure 6—Representative process flow diagram showing meter location for mass balance calculations.

9.1 Mass of CO_2 Received

In accordance with 40 CFR §98.443, Equation RR-2 will be used to calculate the mass of CO_2 received. The mass of CO_2 will be measured at a meter directly downstream from the CO_2 source, marked as M1 on Figure 6. Because there is no redelivery of CO_2, $S_{r,p}$ will be zero ("0"). Quarterly CO_2 concentration will be sampled from a port at gas analyzers adjacent to M1. The Annual Mass of CO_2 Received will be calculated as the total annual mass of CO_2 in the CO_2 stream received in metric tons multiplied by the mass flow by the CO_2 concentration in the flow, according to Equation RR-1.

$$CO_{2,T,r} = \sum_{p=1}^{4} (Q_{r,p} - S_{r,p}) * C_{CO2,p,r} \qquad \text{(Eq. RR-1)}$$

where:
$CO_{2,T,r}$ = Net annual mass of CO_2 received through flow meter r (metric tons).
$Q_{r,p}$ = Quarterly mass flow through a receiving flow meter r in quarter p (metric tons).
$S_{r,p}$ = Quarterly mass flow through a receiving flow meter r that is redelivered to another facility without being injected into your well in quarter p (metric tons).
$C_{CO2,p,r}$ = Quarterly CO_2 concentration measurement in flow for flow meter r in quarter p (wt. percent CO_2, expressed as a decimal fraction).
p = Quarter of the year.
r = Receiving flow meter.

9.2 Mass of CO_2 Injected into the Subsurface

In accordance with 40 CFR §98.443, Equation RR-4 will be used to calculate the mass of CO_2 injected. In accordance with the requirements at 40 CFR §98.444(a), CO_2 will be measured at a meter directly downstream of the CO_2 source. Quarterly CO_2 concentration will be sampled from a port at gas analyzers adjacent to M1 on Figure 6. The Annual CO_2 Mass Injected will be calculated as the mass flow of the CO_2 stream injected each year in metric tons by multiplied by the CO_2 concentration in the flow, according to Equation RR-4.

$$CO_{2,u} = \sum_{p=1}^{4} Q_{p,u} * C_{CO2,p,u} \qquad \text{(Eq. RR-4)}$$

where:
$CO_{2,u}$ = Annual CO_2 mass injected (metric tons) as measured by flow meter u.
$Q_{p,u}$ = Quarterly mass flow rate measurement for flow meter u in quarter p (metric tons per quarter).
$C_{CO2,p,u}$ = Quarterly CO_2 concentration measurement in flow for flow meter u in quarter p (wt. percent CO_2, expressed as a decimal fraction).
p = Quarter of the year.
u = Flow meter.

9.3 Mass of CO_2 Emitted by Surface Leakage

The total annual Mass of CO_2 emitted by Surface Leakage will be calculated and reported using an approach that is tailored to specific Surface Leakage events as described in Section 6.

In accordance with 40 CFR §98.443, Equation RR-10 will be used to calculate and report the Annual Mass of CO_2 emitted by Surface Leakage:

$$CO_{2E} = \sum_{x=1}^{x} CO_{2,x} \qquad \text{(Eq. RR-10)}$$

where:
CO_{2E} = Total annual CO_2 mass emitted by Surface Leakage (metric tons) in the reporting year.
$CO_{2,x}$ = Annual CO_2 mass emitted (metric tons) at leakage pathway x in the reporting year.
x = Leakage pathway.

9.4 Mass of CO_2 Sequestered in Subsurface Geologic Formation

In accordance with 40 CFR §98.443, Equation RR-11 will be used to calculate the Annual Mass of CO_2 Sequestered in Subsurface Geologic Formations in the Reporting Year. Note that the BRP Project does not anticipate producing injected CO_2 in brine removed for pressure maintenance. The geochemistry and isotopic composition of the produced brine will be sampled to confirm the absence of injected CO_2 in the produced brine stream. CO_{2P} and CO_{2FP} will be recorded as “0” unless CO_2 injectate is identified in the brine removed for pressure maintenance. RR-11 will be used to calculate the mass.

$$CO_2 = CO_{2I} - CO_{2P} - CO_{2E} - CO_{2FI} - CO_{2FP} \qquad \text{(Eq. RR-11)}$$

where:
CO_2 = Total annual CO_2 mass sequestered in subsurface geologic formations (metric tons) at the facility in the reporting year.
CO_{2I} = Total annual CO_2 mass injected (metric tons) in the well or group of wells covered by this source category in the reporting year.
CO_{2P} = Total annual CO_2 mass produced (metric tons) in the reporting year.
CO_{2E} = Total annual CO_2 mass emitted (metric tons) by Surface Leakage in the reporting year.
CO_{2FI} = Total annual CO_2 mass emitted (metric tons) from equipment leaks and vented emissions of CO_2 from equipment located on the surface between the flow meter used to measure injection quantity and the injection wellhead, for which a calculation procedure is provided in subpart W of this part.
CO_{2FP} = Total annual CO_2 mass emitted (metric tons) from equipment leaks and vented emissions of CO_2 from equipment located on the surface between the production wellhead and the flow meter used to measure production quantity, for which a calculation procedure is provided in subpart W of this part.

9.5 Cumulative Mass of CO_2 Reported as Sequestered in Subsurface Geologic Formations

The total annual mass obtained using equation RR-11 in 40 CFR §98.443 will be the Cumulative Mass of CO_2 Sequestered in Subsurface Geologic Formations.

10.0 MRV PLAN IMPLEMENTATION SCHEDULE

The BRP Project will commence CO_2 injection in 2025, and the testing and monitoring plan will be in effect. Baseline data will be collected prior to the commencement of CO_2 injection. MRV plan reporting is expected to commence coincident with CO_2 injection or within 90 days of EPA approval, whichever occurs later.

11.0 MONITORING AND QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

OLCV will comply with the requirements of 40 CFR §98.444 as described the BRP Project Quality Assurance and Surveillance Program. The BRP Project utilizes multidisciplinary teams to provide technical expertise and economic inputs to the Project to ensure a safe, successful, and efficient operation. Characterization of the reservoirs, seals, and subsurface features has been done by experienced geoscience professionals using industry-recognized simulation software and techniques. Pipeline, surface equipment, and well materials 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 verify protection of USDWs 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 Oxy's decades of experience in the development and operation of CO_2 Enhanced Oil Recovery (EOR) fields. The Quality Assurance and Surveillance Plan in the UIC Class VI permit addresses, among other topics, (1) the project management and surveillance process at BRP, (2) testing and monitoring techniques, (3) analytical methods, (4) water sampling, (5) continuous recording of injection parameters, (6) reservoir pressure monitoring, and (7) seismic monitoring. In addition, the requirements of 40 CFR §98.444 (a) – (d) have been incorporated into the discussion of the mass balance equations in Section 9 above.

12.0 MISSING DATA PROCEDURES

In the event OLCV is unable to collect data needed for the mass balance calculations, procedures for estimating missing data in 40 CFR §98.445 will be used as follows:

Quarterly Mass of CO_2 Received: A quarterly mass value that is missing will be estimated using a representative mass value from the nearest previous time period.

Quarterly CO_2 Concentration of a CO_2 Stream Received: A quarterly concentration value that is missing will be estimated using a representative concentration value from the nearest previous time period.

Quarterly Quantity of CO_2 Injected: The quarterly amount of CO_2 injected will be estimated using a representative quantity of CO_2 injected from the nearest previous period of time at a similar injection pressure.

Values Associated with CO_2 Emissions from Equipment Leaks and Vented Emissions of CO_2 from Surface Equipment at the Facility: Implementation will follow missing data estimation procedures specified in 40 CFR, Part 98, Subpart W. Any missing data should be followed up with an investigation into issues, whether they are concerned with equipment failure or incorrect estimations.

13.0 RECORDS RETENTION

OLCV will follow the record retention requirements specified by 40 CFR §98.3(g). In addition, it will follow the requirements in 40 CFR §98.447 by maintaining the following records for at least three years:

- Quarterly records of CO_2 received at standard conditions and operating conditions, operating temperature and pressure, and concentration of the streams.
- Quarterly records of injected CO_2, including volumetric flow at standard conditions and operating conditions, operating temperature and pressure, and concentration of the streams.
- Annual records of information used to calculate the CO_2 emitted by Surface Leakage from leakage pathways.
- Annual records of information used to calculate the CO_2 emitted from equipment leaks and vented emissions of CO_2 from equipment located on the surface between the flowmeter used to measure injection quantity and the injection wellhead.

These data will be collected, generated, and aggregated as required for reporting purposes.

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