

**Oxy West Seminole San Andres Unit
Subpart RR Monitoring, Reporting and
Verification (MRV) Plan**

December 11, 2020

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1. Introduction

OXY USA WTP LP, a subsidiary of Occidental (Oxy) operates a CO₂-EOR project in the West Seminole San Andres Unit (WSSAU). This MRV plan was developed in accordance with 40 CFR §98.440-449 (Subpart RR) to provide for the monitoring, reporting and verification of the quantity of CO₂ sequestered at the WSSAU during a specified period of injection.

2. Facility Information

2.1. Reporter Number

575401 – West Seminole San Andres Unit

2.2. UIC Permit Class

The Oil and Gas Division of the Texas Railroad Commission (TRRC) regulates oil and gas activity in Texas. All wells in the WSSAU (including production, injection and monitoring wells) are permitted by TRRC through Texas Administrative Code (TAC) Title 16 Chapter 3. TRRC has primacy to implement the Underground Injection Control (UIC) Class II program in the state for injection wells. All EOR injection wells in the WSSAU are currently classified as UIC Class II wells.

2.3. Existing Wells

Wells in the WSSAU are identified by name and number, API number, type and status. The list of wells as of September 2020 is included in Section 12.1. Any changes in wells will be indicated in the annual report.

3. Project Description

This project takes place in the West Seminole San Andres Unit (WSSAU), an oil field located in West Texas that was first produced more than 70 years ago. CO₂ flooding was initiated in 2013 and the injection plan calls for a total of approximately 20 million tonnes of CO₂ over the lifetime of the project. The field is well characterized and is suitable for secure geologic storage. Oxy uses a water alternating with gas (WAG) injection process and maintains an injection to withdrawal ratio (IWR) of at or near 1.0. A history matched reservoir simulation of the injection at WSSAU has been constructed.

3.1. Project Characteristics

The West Seminole San Andres field was discovered in 1944 and started producing in 1948. The field was unitized in 1961 and waterflood was initiated in 1969. CO₂ flooding was initiated in 2013. A long-term forecast for WSSAU was developed using the reservoir modeling approaches described in Section 3.4 that includes injection of a total of approximately 20 million tonnes of CO₂ over the life of the project. Figure 3-1 shows actual and projected CO₂ injection, production, and stored volumes in WSSAU.

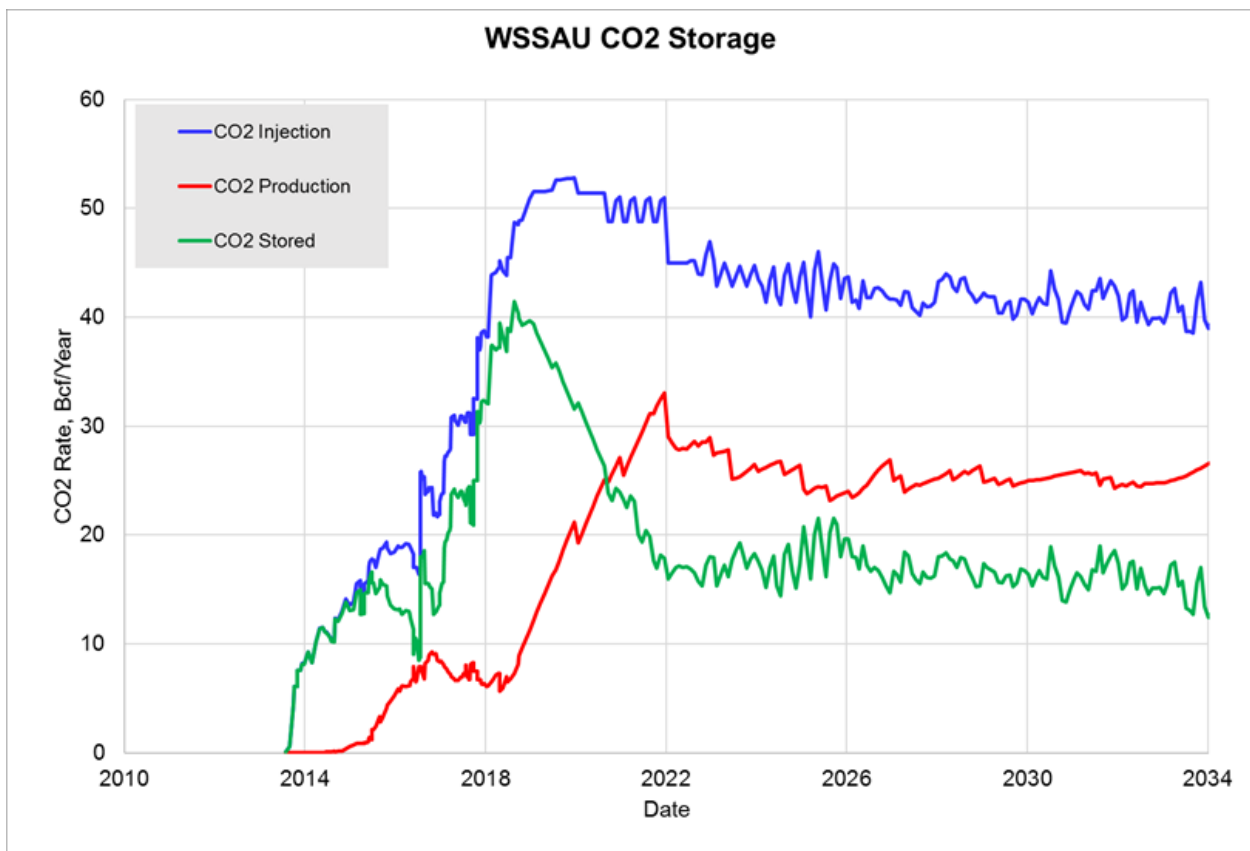


Figure 3-1 WSSAU Historic and Forecast CO₂ Injection, Production, and Storage

3.2. Environmental Setting

The WSSAU is located in the NE portion of the Central Basin Platform in West Texas (See Figure 3-2).

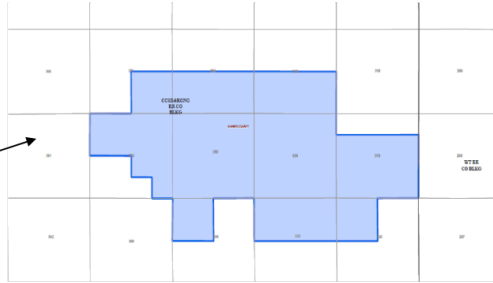
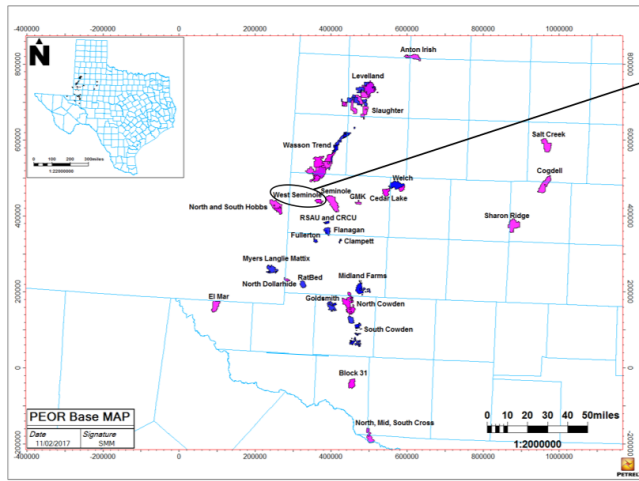


Figure 3-2 Location of WSSAU in West Texas

WSSAU produces oil from the Permian (Guadalupian) aged reservoir comprised of San Andres formation dolostone. Total thickness of the geologic unit is approximately 1500 feet, with the main reservoir within the middle 600 feet. The sequestration zone is also the oil pay completion interval, and ranges on average between 4925-5640 feet below the ground surface. See the WSSAU geologic column in Figure 3-3. The productive interval, or reservoir, is composed of layers of permeable dolomites that were deposited in a shallow marine environment during the Permian Era, some 250 to 300 million years ago.

SYSTEM	SERIES	DELAWARE BASIN	NW SHELF & CENTRAL BASIN PLATFORM	MIDLAND BASIN
QUATERNARY	Holocene	Holocene Sand	Holocene Sand	Alluvium
TERTIARY	Pliocene	Ogallala	Ogallala	Gravels
CRETACEOUS	Gulfian Comanchean	Limestone Sand	Limestone	Limestone
JURASSIC	Absent			
TRIASSIC		Dockum	Dockum	Dockum
PERMIAN	Ochoa	Dewey Lake	Dewey Lake	Dewey Lake
		Rustler	Rustler	Rustler
	Guadalupe	Salado	Salado	Salado
		Castile	Castile	Castile
		Bell Canyon	Bell Canyon	Tansill
		Cherry Canyon	Cherry Canyon	Yates
		Brushy Canyon	Brushy Canyon	SevenRivers
		Victoria Peak	Victoria Peak	Queen
		Leonard	Leonard	Grayburg
				San Andres
		Glorieta Ss.		
		Clear Fork		
		Wichita-Abc		
		Wichita		
PENNSYLVANIAN	Wolfcamp	Wolfcamp	Wolfcamp	Wolfcamp
	Virgil	Virgil	Virgil	Virgil
	Missouri	Missouri	Missouri	Missouri
	Des Moines	Strawn	Strawn	Strawn
MISSISSIPPIAN	Atoka	Atoka	Atoka	Atoka
	Morrow	Morrow	Morrow	Morrow
	Chester	Barnett	Osage	Mississippian Limestone
DEVONIAN	Upper	Woodford	Woodford	Woodford
	Middle	Thirty one	Thirty one	Thirty one
SILURIAN	Middle	Wristen	Wristen	Fuselman
	Upper	Fuselman	Fuselman	Fuselman
ORDOVICIAN	Upper	Montoya	Montoya	Montoya
	Middle	Simpson	Simpson	Simpson
CAMBRIAN	Upper	Ellenburger	Ellenburger	Ellenburger
	Lower	Ellenburger	Ellenburger	Ellenburger
PRE CAMBRIAN	Upper	Cambrian	Cambrian Ss.	Cambrian Ss.
	Lower	Pre Cambrian	Pre Cambrian	Pre Cambrian

SYSTEM	SERIES	NW SHELF & CENTRAL BASIN PLATFORM	Depth (MD)	
QUATERNARY	Holocene	Holocene Sand		
TERTIARY	Pliocene	Ogallala	200ft	
CRETACEOUS	Gulfian Comanchean	Limestone		
JURASSIC	Absent			
TRIASSIC		Dockum		
PERMIAN	Ochoa	Dewey Lake		
		Rustler		
	Guadalupe	Salado		2200ft
		Castile		
		Bell Canyon	Tansill	
		Cherry Canyon	Yates	
		Brushy Canyon	SevenRivers	
		Victoria Peak	Queen	
		Leonard	Grayburg	4600ft
			San Andres	6300ft
	Glorieta Ss.			
	Clear Fork			
	Wichita-Abc			

Key

- USDW USDW
- Brine Brine
- Non-permeable "seals" or "caps" Non-permeable "seals" or "caps"
- Storage Complex Storage Complex

Highlighted area is blown up above

Figure 3-3 WSSAU Geologic Column

The main confining system is ~300 feet thick and is comprised of nonporous anhydrite sequences. The depth interval for the confining system ranges from top San Andres Formation to Top Pay (4545-5194 feet) with a typical range of 4660-4925 feet below ground surface. There are numerous relatively thin layers that provide additional secondary containment between the sequestration zone and freshwater aquifers. These layers are comprised of siltstones, shales, salts, and anhydrite sequences with little to no porosity or permeability.

There are no significant geologic faults or fractures identified that intersect the storage complex. There is one identified reverse fault in the Devonian interval approximately one mile below the sequestration zone. The base of sequestration zone is approximately 2175 ft. subsea depth, while the top of fault offset is interpreted to end at approximately 7500 ft. subsea depth. Fault displacement within the Devonian is approximately 200 ft. The fault is linear, subvertical, and dips toward the northeast. The presence of a gas cap is evidence of the effectiveness of the seal formed by the upper San Andres.

WSSAU is a domal structure that includes the highest elevations within the area. The elevated area forms a natural trap for oil and gas that migrated from below over millions of years. Once trapped in these high points, the oil and gas has remained in place. In the case of the WSSAU, this oil and gas has been trapped in the reservoir for 50 to 100 million years. Over time, buoyant fluids, including CO₂, rise vertically until reaching the ceiling of the dome and then migrate to the highest elevation of the structure. Figure 3-4, shows the Top San Andres pay interval structure. The colors in the structure map in Figure 3-4 indicate the subsurface elevation, with red being higher, (a shallower level) and purple being lower (a deeper level).

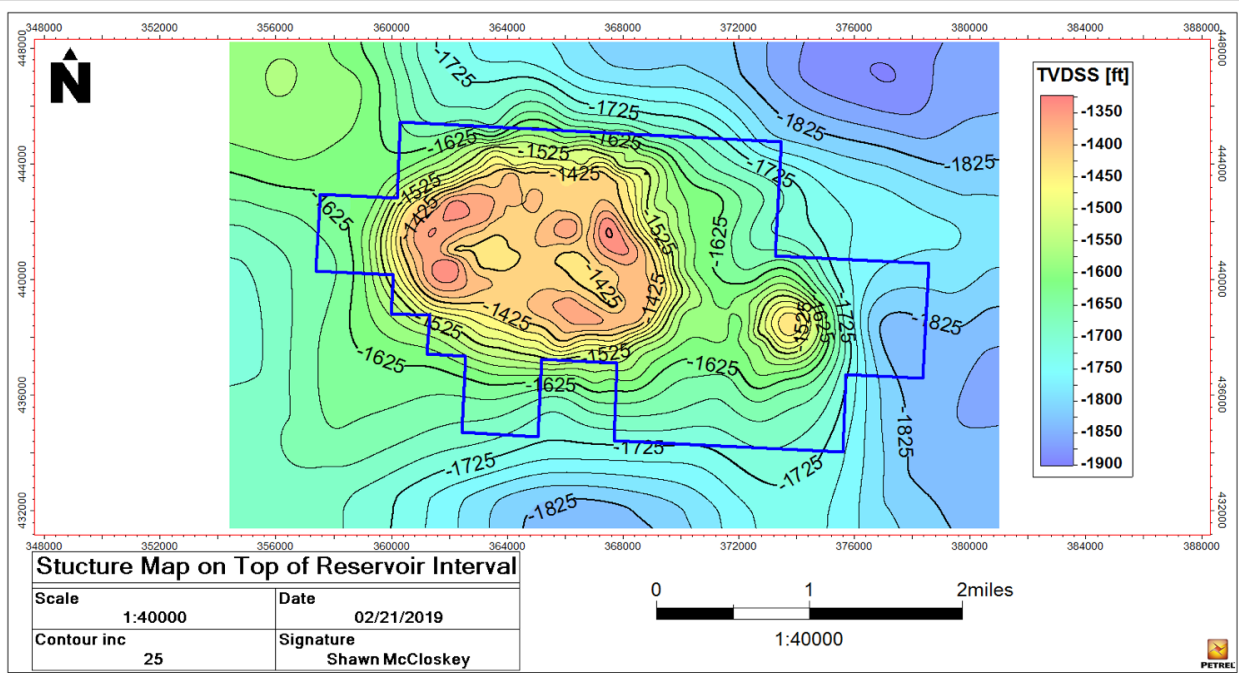


Figure 3-4 Local Area Structure on Top of San Andres

Buoyancy dominates where oil and gas are found in a reservoir. Gas, being lightest, rises to the top and water, being heavier, moves downward. Oil, being heavier than gas but lighter than water, lies in between. At the time of its discovery, natural gas was trapped at the structural high points of WSSAU, forming a “gas cap.” The presence of an oil deposit and a gas cap is evidence of the effectiveness of the seal formed by the upper San Andres. Gas is buoyant and highly mobile. If it could escape WSSAU naturally, through faults or fractures, it would have done so over the millennia. Below the gas cap is an oil accumulation, the oil zone, and below that there are no distillable hydrocarbons.

Once the CO₂ flood is complete and injection ceases, the remaining mobile CO₂ will rise slowly upward, driven by buoyancy forces. There is more than enough pore space to sequester the planned CO₂ injection. The amount of CO₂ injected will not exceed the reservoir’s secure storage capacity and, consequently, the risk that CO₂ could migrate to other reservoirs in the Central Basin Platform is negligible. The volume of CO₂ storage is based on the estimated total pore space within WSSAU. The total pore space within WSSAU, from the top of the reservoir down to the base of the oil zone, is calculated to be 1,512 million reservoir barrels (RB). This is the volume of rock multiplied by porosity. Table 3-1 below shows the conversion of this amount of pore space into an estimated maximum volume of approximately 1,770 Bcf (96 million tonnes) of CO₂ storage in the reservoir. It is forecasted that at the end of EOR operations stored CO₂ will fill approximately 20% of total calculated storage capacity.

Table 3-1 Calculation of Maximum Volume of CO₂ Storage Capacity at WSSAU

Top of Pay to Free Water Level (2175 ft subsea)	
Variables	WSSAU Outline
Pore Volume (RB)	1,511,810,594
B_{CO2}	0.45
S_{wirr}	0.2
S_{orCO2}(volume weighted)	0.273
Max CO₂ (MCF)	1,770,498,185
Max CO₂ (BCF)	1,770

$$\text{Max CO}_2 = \text{Volume (RB)} * (1 - S_{wirr} - S_{orCO2}) / B_{CO2}$$

Where:

- CO₂(max) = the maximum amount of storage capacity
- Pore Volume (RB) = the volume in Reservoir Barrels of the rock formation
- B_{CO2} = the formation volume factor for CO₂
- S_{wirr} = the irreducible water saturation
- S_{orCO2} = the irreducible oil saturation

Given that WSSAU is located at the highest subsurface elevations in the area, that the confining zone has proved competent over both millions of years and current CO₂ flooding, and that the WSSAU has ample storage capacity, there is confidence that stored CO₂ will be contained securely within the reservoir.

3.3. Description of CO₂-EOR Project Facilities and the Injection Process

Figure 3-5 shows a simplified process flow diagram of the project facilities and equipment in the WSSAU. CO₂ is delivered to the WSSAU via the Permian Basin CO₂ pipeline network. The CO₂ is supplied by a number of different sources. Specified amounts are drawn from the Bravo pipeline based on contractual arrangements among suppliers of CO₂, purchasers of CO₂, and the pipeline operator.

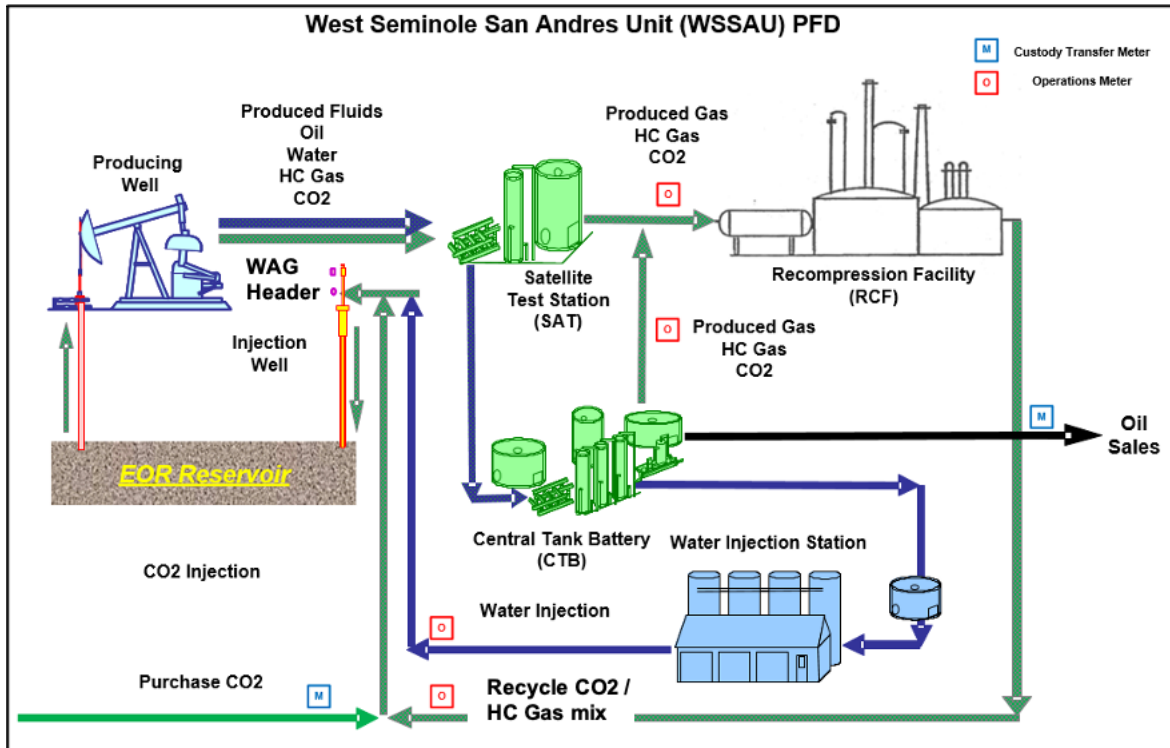


Figure 3-5 WSSAU Process Flow Diagram

Once CO₂ enters WSSAU there are three main processes involved in EOR operations:

- i. CO₂ Distribution and Injection. The mass of CO₂ received at WSSAU is metered and calculated through the Custody Transfer Meter located at the pipeline delivery point as indicated in the bottom left of Figure 3-5. The mass of CO₂ received is combined with recycled CO₂ / hydrocarbon gas mix from the recompression facility (RCF) and distributed to the WAG headers for injection into the injection wells according to the pre-programmed injection plan for each well pattern which alternates between water and CO₂ injection. WAG headers are remotely operated and can inject either CO₂ or water at various rates and injection pressures as specified in the injection plans. This is an EOR project and reservoir pressure must be maintained above minimum miscibility pressure. Therefore, injection pressure must be sufficiently high to allow injectants to enter the reservoir, but below formation parting pressure (FPP).
- ii. Produced Fluids Handling. Produced fluids from the production wells are a mixture of oil, hydrocarbon gas, water, CO₂ and trace amounts of other constituents in the field including nitrogen and H₂S as discussed in Section 7. They are gathered and sent to satellite test stations (SAT) for separation into a gas/CO₂ mix and a produced fluids mix of water, oil, gas, and CO₂.

The produced gas, which is composed primarily of hydrocarbons and CO₂, is sent to the recompression facility (RCF) for dehydration and recompression before reinjection into the reservoir. An operations meter at the RCF is used to determine the total volume of produced gas that is reinjected. The separated oil is metered through the Custody Transfer Meter located at the central tank battery and sold into a pipeline.

iii. Water Treatment and Injection. Water is recovered for reuse and forwarded to the water injection station for treatment and reinjection or disposal.

3.3.1. Wells in the WSSAU

The Texas Railroad Commission (TRRC) has broad authority over oil and gas operations including primacy to implement UIC Class II wells. The rules are found in Texas Administrative Code Title 16, Part 1, Chapter 3 and are also explained in a TRRC Injection/Disposal Well Permitting, Testing and Monitoring Manual (See Appendix 12-3). TRRC rules govern well siting, construction, operation, maintenance, and closure for all wells in oilfields. Briefly, TRRC rules include the following requirements:

- Fluids must be constrained in the strata in which they are encountered;
- Activities cannot result in the pollution of subsurface or surface water;
- Wells must adhere to specified casing, cementing, drilling well control, and completion requirements designed to prevent fluids from moving from the strata they are encountered into other strata with oil and gas, or into subsurface and surface waters;
- Completion report for each well including basic electric log (e.g., a density, sonic, or resistivity (except dip meter) log run over the entire wellbore) must be prepared;
- Operators must follow plugging procedures that require advance approval from the TRRC Director and allow consideration of the suitability of the cement based on the use of the well, the location and setting of plugs; and,
- Injection well operators must identify an Area of Review (AoR), use compatible materials and equipment, test, and maintain well records.

Table 2 provides a well count by type and status. All these wells are in material compliance with TRRC rules.

Table 1 WSSAU Well Penetrations by Type and Status

TYPE	ACTIVE	Dry & Abandoned	INACTIVE	P & A*	SHUT-IN	TA**	Total
DISP H2O	2			2			4
INJ GAS					1		1
INJ H2O	23		7	25	3	5	63
INJ WAG	35						35
OBSERVATION	1					1	2
PROD GAS						3	3
PROD OIL	80	2	4	16		16	118
SUP H2O						1	1
TOTAL	141	2	11	43	4	26	227

*P&A = Plugged and Abandoned

**TA = Temporarily Abandoned

As indicated in Figure 3-6, wells are distributed across the WSSAU. The well patterns currently undergoing CO₂ flooding are outlined in the black box and CO₂ will be injected across the entire unit over the project life.

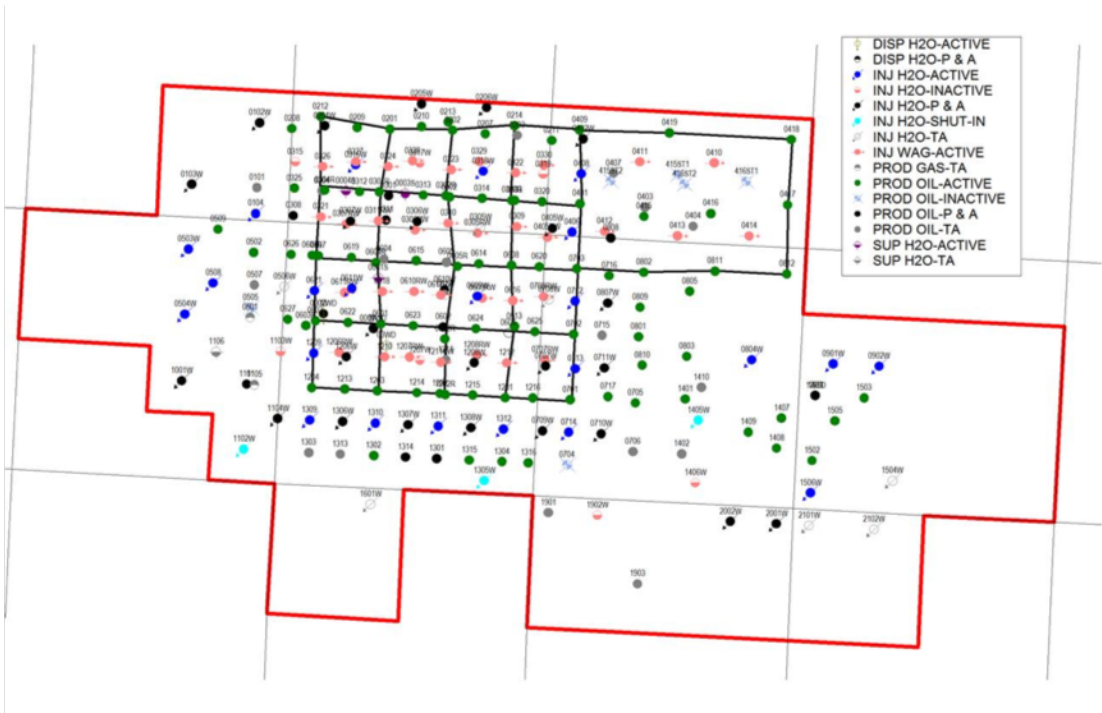


Figure 3-6 WSSAU Wells and Injection Patterns

WSSAU CO₂ EOR operations are designed to avoid conditions which could damage the reservoir and cause a potential leakage pathway. Reservoir pressure in the WSSAU is managed

by maintaining an injection to withdrawal ratio (IWR)¹ of approximately 1.0. To maintain the IWR, fluid injection and production are monitored and managed to ensure that reservoir pressure does not increase to a level that would compromise the reservoir seal or otherwise damage the integrity of the oil field.

Injection pressure is also maintained below the FPP, which is measured using step-rate tests.

3.4. Reservoir modeling

A history matched reservoir model of the current and forecast WSSAU CO₂ injection has been made. The model was constructed using Eclipse software which is a commercially available reservoir simulation code. The model simulates the recovery mechanism in which CO₂ is miscible with the hydrocarbon in the reservoir.

The model was created to:

- i. Demonstrate that the storage complex has, at the minimum, the capacity to contain the planned volume of purchased CO₂.
- ii. Track injected CO₂, identify how and where CO₂ is trapped in the WSSAU, and to monitor sequestration volumes and distribution.

The reservoir model utilizes four types of data:

- i. Site Characteristics as described in the WSSAU Geomodel,
- ii. Initial reservoir conditions and fluid property data
- iii. Capillary pressure data, and
- iv. Well data

The geomodel used as the foundation for the reservoir model used data from 232 wells in the area of interest that includes WSSAU. These wells have digital open- or cased-hole logs that were used for correlation of formation tops. A sequence stratigraphic framework was developed based upon core descriptions and outcrop analogs, this correlation framework was then extrapolated to well logs. The sequence stratigraphic correlations are picked at the base of mud-dominated flooding surfaces mapped out in core and extrapolated to well logs throughout the rest of the field.

The model is a four-component model consisting of water, oil, reservoir gas and injected CO₂. It is an extension of the black oil model that enables the modeling of recovery mechanisms in which the injected CO₂ is miscible with reservoir oil. This is a reasonable assumption since the reservoir under study is above minimum miscibility pressure (MMP). The total hydrocarbon and solvent (CO₂) saturation is used to calculate relative permeability to water. The solvent and oil relative permeability are then calculated using multipliers from a look-up table. The Todd-

¹ Injection to withdrawal ratio (IWR) is the ratio of the volume of fluids injected to the volume of fluids produced (withdrawn). Volumes are measured under reservoir conditions for all fluids. By keeping IWR close to 1.0, reservoir pressure is held constant, neither increasing nor decreasing.

Longstaff² model is used to calculate the effective viscosity and density of the hydrocarbon and solvent phases.

History matching is the process of adjusting input parameters within the range of data uncertainties until the actual reservoir performance is closely reproduced in the model. A 70-year history match was obtained. All three-phase rates (oil, gas, and water) are included in the history record. The model uses liquid rate control (combination of oil and water) for the history match.

The graphs in Figure 3-7 present the history match results of oil rate, gas rates, water rates, and water cut and show that the reservoir model provides an excellent match to actual historic data. Figure 3-8 shows the match of water and CO₂ injection.

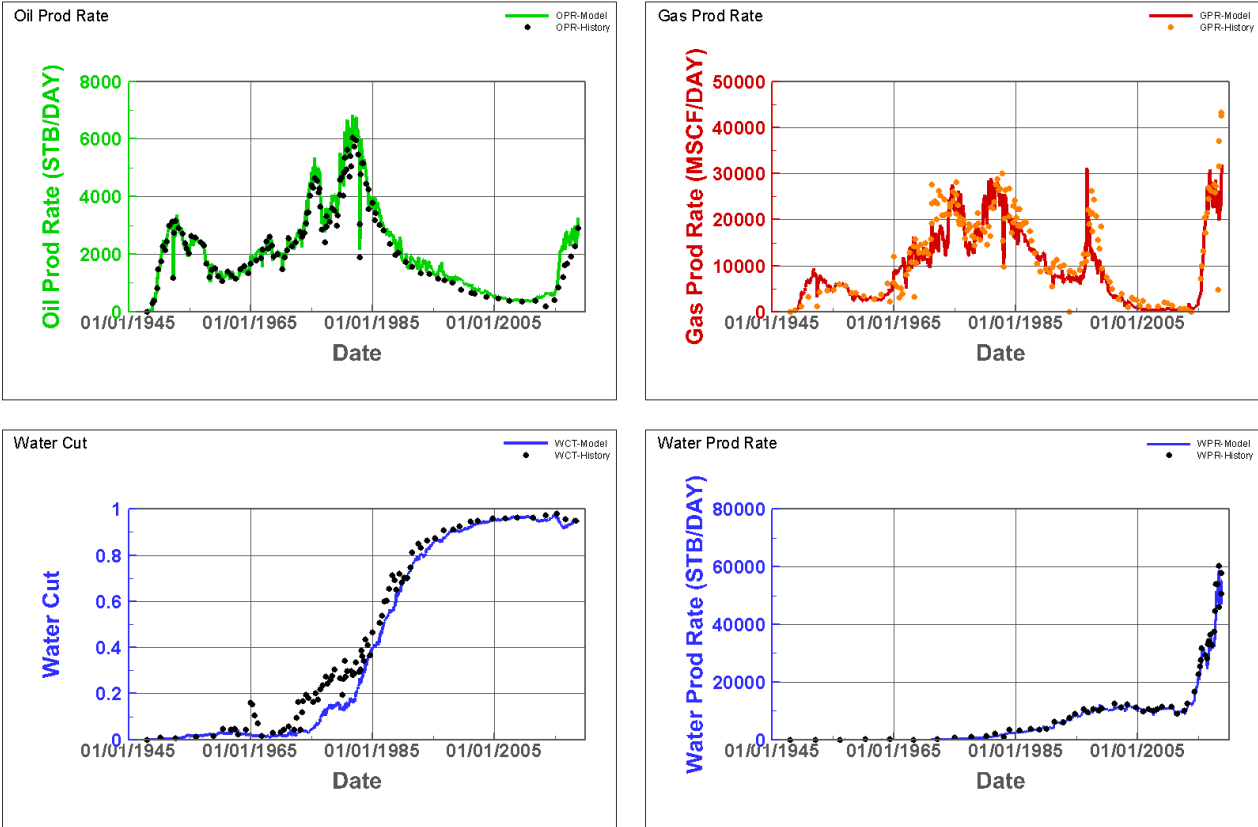


Figure 3-7 Four Parameters of History-Matched Modeling in the WSSAU Reservoir Model

² Todd, M.R., Longstaff, W.J.: The development, testing and application of a numerical simulator for predicting miscible flood performance. J. Petrol. Tech. 24(7), 874–882 (1972)

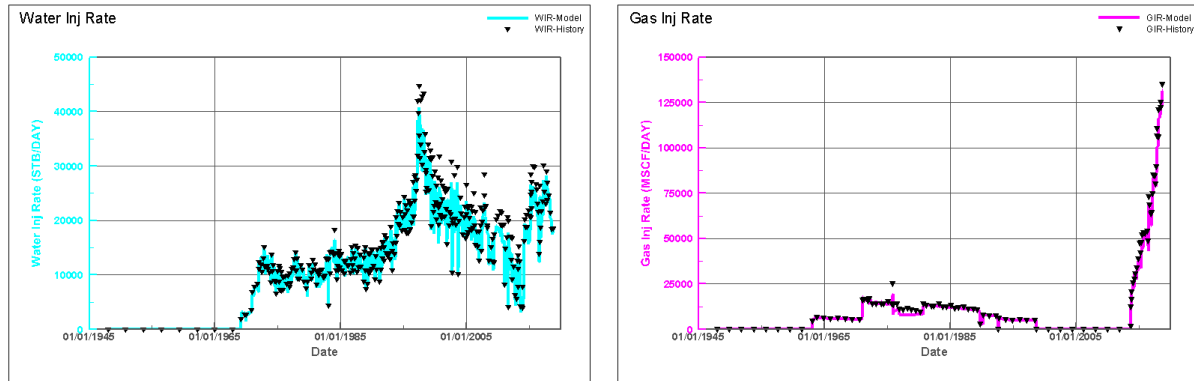


Figure 3-8 Plots of Injection History Match in the WSSAU Reservoir Model

The WSSAU reservoir model was used to evaluate the plume of CO₂ using a set of injection, production, and facilities constraints that describe the injection plan. The history match indicates that the model is robust and that there is little chance that uncertainty about any specific variable will have a meaningful impact on the reservoir CO₂ storage performance. The model forecast showed that CO₂ is contained in the reservoir within the boundaries of WSSAU.

4. Delineation of Monitoring Area and Timeframes

4.1. Active Monitoring Area

The Active Monitoring Area (AMA) is defined by the boundary of the WSSAU plus the required ½ mile buffer.

4.2. Maximum Monitoring Area

The Maximum Monitoring Area (MMA) is defined by the boundary of the WSSAU plus the required ½ mile buffer as required by 40 CFR §98.440-449 (Subpart RR).

4.3. Monitoring Timeframes

The primary purpose for injecting CO₂ is to produce oil that would otherwise remain trapped in the reservoir and not, as in UIC Class VI, “specifically for the purpose of geologic storage.”³ During a Specified Period, there will be a subsidiary purpose of establishing the long-term containment of CO₂ in the WSSAU. The Specified Period will be shorter than the period of production from the WSSAU.

At the conclusion of the Specified Period, a request for discontinuation of reporting will be submitted. This request will be submitted with a demonstration that current monitoring and model(s) show that the cumulative mass of CO₂ reported as sequestered during the Specified Period is not expected to migrate in the future in a manner likely to result in surface leakage. It is expected that it will be possible to make this demonstration almost immediately after the Specified Period ends based upon predictive modeling supported by monitoring data.

The reservoir pressure in the WSSAU is collected for use reservoir modeling and operations management. Reservoir pressure is not forecast to change appreciably since the IWR will be maintained at approximately 1.0. The reservoir model shows that by the end of CO₂ injection, average reservoir pressure will be approximately 2,360 psi. Once injection ceases, reservoir pressure is predicted to stabilize within one year. Over time, reservoir pressure is expected to drop by approximately 10 psi. The trend of the reservoir pressure decline will be one of the bases of a request to discontinue monitoring and reporting.

³ EPA UIC Class VI rule, EPA 75 FR 77291, December 10, 2010, section 146.81(b).

5. Evaluation of Potential Pathways for Leakage to the Surface, Leakage Detection, Verification, and Quantification

In the roughly 70 years since the oil field of the WSSAU was discovered, the reservoir has been studied and documented extensively. Based on the knowledge gained from that experience, this section assesses the potential pathways for leakage of stored CO₂ to the surface including:

- i. Existing Well Bores
- ii. Faults and Fractures
- iii. Natural and Induced Seismic Activity
- iv. Previous Operations
- v. Pipeline/Surface Equipment
- vi. Lateral Migration Outside the WSSAU
- vii. Drilling Through the CO₂ Area
- viii. Diffuse Leakage Through the Seal

This analysis shows that leakage through wellbores and surface equipment pose the only meaningful potential leakage pathways. The monitoring program to detect and quantify leakage is based on this assessment as discussed below.

5.1. Existing Wellbores

As part of the TRRC requirement to initiate CO₂ flooding, an extensive review of all WSSAU penetrations was completed to determine the need for corrective action. That analysis showed that all penetrations have either been adequately plugged and abandoned or, if in use, do not require corrective action. All wells in the WSSAU were constructed and are operated in compliance with TRRC rules.

As part of routine risk management, the potential risk of leakage associated with the following were identified and evaluated:

- i. CO₂ flood beam wells
- ii. Electrical submersible pump (ESP) producer wells, and
- iii. CO₂ WAG injector wells.

The risk assessment classified all risks associated with subsurface as low risk, i.e., less than 1% likelihood to occur and having a consequence that is insubstantial. The risks were classified as low risk because, the WSSAU geology is well suited to CO₂ sequestration with an extensive confining zone that is free of fractures and faults that could be potential conduits for CO₂ migration. The low risk is supported by the results of the reservoir model which shows that stored CO₂ is not predicted to leave the WSSAU boundary. Any risks are further mitigated because the WSSAU is operated in a manner that maintains, monitors, and documents the integrity of the reservoir.

The risk of well leakage is mitigated through:

- i. Adhering to regulatory requirements for well drilling and testing;
- ii. implementing best practices that Oxy has developed through its extensive operating experience;

- iii. monitoring injection/production performance, wellbores, and the surface; and,
- iv. maintaining surface equipment.

Continual and routine monitoring of the wellbores and site operations will be used to detect leaks or other potential well problems, as follows:

- Pressure in injection wells is monitored on a continual basis. The injection plans for each pattern are programmed into the injection WAG satellite to govern the rate, pressure, and duration of either water or CO₂ injection. Pressure monitors on the injection wells are programmed to flag whenever statistically significant pressure deviations from the targeted ranges in the plan are identified. Leakage on the inside or outside of the injection wellbore would affect pressure and be detected through this approach. If such events occur, they are investigated and addressed. Oxy's experience, from over 40 years of operating CO₂ EOR projects, is that such leakage is very rare and there have been no incidents of fluid migration out of the intended zone at WSSAU.
- Production well performance is monitored using the production well test process conducted when produced fluids are gathered and sent to an SAT. There is a routine well testing cycle for each SAT, with each well being tested approximately once every two months. During this cycle, each production well is diverted to the well test equipment for a period of time sufficient to measure and sample produced fluids (generally 8-12 hours). These tests are the basis for allocating a portion of the produced fluids measured at the SAT to each production well, assessing the composition of produced fluids by location, and assessing the performance of each well. Performance data are reviewed on a routine basis to ensure that CO₂ flooding efficiency is optimized. If production is off the plan, it is investigated and any identified issues addressed. Leakage to the outside of production wells is not considered a major risk because of the reduced pressure in the casing. Further, the personal H₂S monitors are designed to detect leaked fluids around production wells during well inspections.
- Field inspections are conducted on a routine basis by field personnel. Leaking CO₂ is very cold and leads to formation of bright white clouds and ice that are easily spotted. All field personnel are trained to identify leaking CO₂ and other potential problems at wellbores and in the field. Any CO₂ leakage detected will be documented and reported and quantified.

Based on ongoing monitoring activities and review of the potential leakage risks posed by well bores, it is concluded that the risk of CO₂ leakage through well bores is being mitigated by detecting problems as they arise and quantifying any leakage that does occur.

5.2. Faults and Fractures

After reviewing geologic, seismic, operating, and other evidence, it has been concluded that there are no known faults or fractures that transect the San Andres reservoir in the project area. As a result, there is no risk of leakage due to fractures or faults.

Measurements to determine FPP and reservoir pressure are routinely updated. This information is used to manage injection patterns so that the injection pressure will not exceed FPP. An IWR

at or near 1 is also maintained. Both of these measures mitigate the potential for inducing faults or fractures. As a safeguard, WAG skids are continuously monitored and set with automatic shutoff controls if injection pressures exceed programmed levels.

5.3. Natural or Induced Seismicity

After reviewing the literature and actual operating experience, it is concluded that there is no direct evidence that natural seismic activity poses a significant risk for loss of CO₂ to the surface in the Permian Basin, and specifically in the WSSAU.

To evaluate this potential risk at WSSAU, Oxy has reviewed the nature and location of seismic events in West Texas. Some of the recorded earthquakes in West Texas are far removed from any injection operation. These are judged to be from natural causes. Others are near oil fields or water disposal wells and are placed in the category of “quakes in close association with human enterprise.”⁴ A review of the USGS database of recorded earthquakes at M3.0 or greater in the Permian Basin indicates that none have occurred in the West Seminole Field; the closest took place in 1992 approximately 35 miles away. The concern about induced seismicity is that it could lead to fractures in the seal providing a pathway for CO₂ leakage to the surface. Oxy is not aware of any reported loss of injectant (brine water or CO₂) to the surface associated with any seismic activity. There is no direct evidence to suggest that natural seismic activity poses a significant risk for loss of CO₂ to the surface in the Permian Basin, and specifically in the WSSAU. If induced seismicity resulted in a pathway for material amounts of CO₂ to migrate from the injection zone, other reservoir fluid monitoring provisions (e.g., reservoir pressure, well pressure, and pattern monitoring) would detect the migration and lead to further investigation. Oxy also participates in the TexNet seismic monitoring network⁵ and will continue to monitor for seismic signals that could indicate the creation of potential leakage pathways in WSSAU.

5.4. Previous Operations

CO₂ flooding was initiated in WSSAU in 2013. To obtain permits for CO₂ flooding, the AoR around all CO₂ injector wells was evaluated to determine if there were any unknown penetrations and to assess if corrective action was required at any wells. As indicated in Section 5.1, this evaluation reviewed the identified penetrations and determined that no additional corrective action was needed. Further, Oxy’s standard practice for drilling new wells includes a rigorous review of nearby wells to ensure that drilling will not cause damage to or interfere with existing wells. And, requirements to construct wells with materials that are designed for CO₂ injection are adhered to at WSSAU. These practices ensure that there are no unknown wells within WSSAU and that the risk of migration from older wells has been sufficiently mitigated. The successful experience with CO₂ flooding in WSSAU demonstrates that the confining zone has not been impaired by previous operations.

⁴ Frohlich, Cliff (2012) “Induced or Triggered Earthquakes in Texas: Assessment of Current Knowledge and Suggestions for Future Research”, Final Technical Report, Institute for Geophysics, University of Texas at Austin, Office of Sponsored Research.

⁵ <https://www.beg.utexas.edu/texnet-cisr/texnet>

5.5. Pipelines and Surface Equipment

As part of routine risk management described in Section 5, the potential risk of leakage associated with the following are identified and evaluated:

- i. The production satellite
- ii. The Central Tank Battery; and
- iii. Facility pipelines.

As described in Section 5.1, the risk assessment classified all subsurface risks as low risk, i.e., less than 1% likelihood to occur and having a consequence that is insubstantial. The risks associated with pipelines and surface equipment were classified as low risk because, the WSSAU is operated in a manner that maintains, monitors, and documents the integrity of the reservoir.

The risk of well leakage is mitigated through:

- i. Adhering to regulatory requirements for well drilling and testing;
- ii. implementing best practices that Oxy has developed through its extensive operating experience;
- iii. monitoring injection/production performance, wellbores, and the surface; and,
- iv. maintaining surface equipment.

Personnel continuously monitor the pipeline system using the SCADA system and are able to detect and mitigate pipeline leaks expeditiously. Such risks will be prevented, to the extent possible, by relying on the use of prevailing design and construction practices and maintaining compliance with applicable regulations. The facilities and pipelines currently utilize and will continue to utilize materials of construction and control processes that are standard for CO₂ EOR projects in the oil and gas industry. Operating and maintenance practices currently follow and will continue to follow demonstrated industry standards. CO₂ delivery via the Permian Basin CO₂ pipeline system will continue to comply with all applicable regulations. Finally, routine visual inspection of surface facilities by field staff will provide an additional way to detect leaks and further support the efforts to detect and remedy any leaks in a timely manner. Should leakage be detected from pipeline or surface equipment, the volume of released CO₂ will be quantified following the requirements of Subpart W of EPA's GHGRP.

5.6. Lateral Migration Outside the WSSAU

It is highly unlikely that injected CO₂ will migrate down dip and laterally outside the WSSAU because of the nature of the geology and the approach used for injection. First, WSSAU is situated in the highest local elevations within the San Andres. This means that over long periods of time, injected CO₂ will tend to rise vertically towards the Upper San Andres and continue towards the point in the WSSAU with the highest elevation. Second, the planned injection volumes and active fluid management during injection operations will prevent CO₂ from migrating laterally out of the structure. Finally, the total volume of fluids contained in the WSSAU will stay relatively constant. Based on site characterization and planned and projected operations it is estimated that the total volume of stored CO₂ will be considerably less than calculated capacity.

5.7. Drilling in the WSSAU

The TRRC regulates well drilling activity in Texas. Pursuant to TRRC rules, wells casing shall be securely anchored in the hole in order to effectively control the well at all times, all usable-quality water zones shall be isolated and sealed off to effectively prevent contamination or harm, and all productive zones, potential flow zones, and zones with corrosive formation fluids shall be isolated and sealed off to prevent vertical migration of fluids, including gases, behind the casing. Where TRRC rules do not detail specific methods to achieve these objectives, operators shall make every effort to follow the intent of the section, using good engineering practices and the best currently available technology. The TRRC requires applications and approvals before a well is drilled, recompleted, or reentered. Well drilling activity at WSSAU is conducted in accordance with TRRC rules. Oxy's visual inspection process, including routine site visits, will identify unapproved drilling activity in the WSSAU.

In addition, Oxy intends to operate WSSAU for several more decades and will continue to be vigilant about protecting the integrity of its assets and maximizing the potential of its resources, including oil, gas and CO₂. Consequently, the risks associated with third parties penetrating the WSSAU are negligible.

5.8. Diffuse Leakage Through the Seal

Diffuse leakage through the seal formed by the upper San Andres is highly unlikely. The presence of a gas cap trapped over millions of years confirms that the seal has been secure. Injection pattern monitoring assures that no breach of the seal will be created. Wellbores that penetrate the seal make use of cement and steel construction that is closely regulated to ensure that no leakage takes place. Injection pressure is continuously monitored and unexplained changes in injection pressure that might indicate leakage would trigger investigation as to the cause.

5.9. Leakage Detection, Verification, and Quantification

As discussed above, the potential sources of leakage include issues, such as problems with surface equipment (pumps, valves, etc.) or subsurface equipment (well bores), and unique events such as induced fractures. An event-driven process to assess, address, track, and if applicable quantify potential CO₂ leakage is used. Table 3 summarizes some of these potential leakage scenarios, the monitoring activities designed to detect those leaks, the standard response, and other applicable regulatory programs requiring similar reporting.

Given the uncertainty concerning the nature and characteristics of any leaks that may be encountered, the most appropriate methods for quantifying the volume of leaked CO₂ will be determined on a case by case basis. In the event leakage occurs, the most appropriate methods for quantifying the volume leaked will be determined and it will be reported as required as part of the annual Subpart RR submission.

Any volume of CO₂ detected leaking to surface will be quantified using acceptable emission factors such as those found in 40 CFR Part 98 Subpart W or engineering estimates of leak amounts based on measurements in the subsurface, field experience, and other factors such as the frequency of inspection. Leaks will be documented, evaluated and addressed in a timely manner.

Records of leakage events will be retained in the electronic environmental documentation and reporting system. Repairs requiring a work order will be documented in the electronic equipment maintenance system.

Table 2 Response Plan for CO₂ Loss

Risk	Monitoring Plan	Response Plan
Tubing Leak	Monitor changes in tubing and annulus pressure; MIT for injectors	Wellbore is shut in and workover crews respond within days
Casing Leak	Routine Field inspection; Monitor changes in annulus pressure, MIT for injectors; extra attention to high risk wells	Well is shut in and workover crews respond within days
Wellhead Leak	Routine Field inspection, SCADA system monitors wellhead pressure	Well is shut in and workover crews respond within days
Loss of Bottom-hole pressure control	Blowout during well operations	Maintain well kill procedures
Unplanned wells drilled through San Andres	Routine Field inspection to prevent unapproved drilling; compliance with TRRC permitting for planned wells.	Assure compliance with TRRC regulations
Loss of seal in abandoned wells	Reservoir pressure in WAG headers; high pressure found in new wells	Re-enter and reseal abandoned wells
Pumps, valves, etc.	Routine Field inspection, SCADA	Workover crews respond within days
Overfill beyond spill points	Reservoir pressure in WAG headers; high pressure found in new wells	Fluid management along lease lines
Leakage through induced fractures	Reservoir pressure in WAG headers; high pressure found in new wells	Comply with rules for keeping pressures below parting pressure
Leakage due to seismic event	Reservoir pressure in WAG headers; high pressure found in new wells	Shut in injectors near seismic event

5.10. Summary

The structure and stratigraphy of the San Andres reservoir in the WSSAU is ideally suited for the injection and storage of CO₂. The stratigraphy within the CO₂ injection zones is porous, permeable and thick, providing ample capacity for long-term CO₂ storage. The reservoir is overlain by several intervals of impermeable geologic zones that form effective seals or “caps” to fluids in the reservoir. After assessing potential risk of release from the subsurface and steps that have been taken to prevent leaks, it has been determined that the potential threat of leakage is extremely low.

In summary, based on a careful assessment of the potential risk of release of CO₂ from the subsurface, it has been determined that there are no leakage pathways at the WSSAU that are likely to result in significant loss of CO₂ to the atmosphere. Further, given the detailed knowledge of the field and its operating protocols, it is concluded that any CO₂ leakage to the surface that could arise through either identified or unexpected leakage pathways would be detected and quantified.

6. Monitoring and Considerations for Calculating Site Specific Variables

Monitoring will also be used to determine the quantities in the mass balance equation and to make the demonstration that the CO₂ plume will not migrate to the surface after the time of discontinuation.

6.1. For the Mass Balance Equation

6.1.1. General Monitoring Procedures

Flow rate, pressure, and gas composition data are monitored and collected from the WSSAU in centralized data management systems as part of ongoing operations. These data are monitored by qualified technicians who follow response and reporting protocols when the systems deliver notifications that data exceed statistically acceptable boundaries.

Metering protocols used at WSSAU follow the prevailing industry standard(s) for custody transfer as currently promulgated by the API, the American Gas Association (AGA), and the Gas Processors Association (GPA), as appropriate. This approach is consistent with EPA GHGRP's Subpart RR, section 98.444(e)(3). These meters will be maintained routinely, operated continually, and will feed data directly to the centralized data collection systems. The meters meet the industry standard for custody transfer meter accuracy and calibration frequency.

6.1.2. CO₂ Received

As indicated in Figure 3-5, the volume of received CO₂ is measured using a commercial custody transfer meter at the point at which custody of the CO₂ from the Permian Basin CO₂ pipeline delivery system is transferred to the WSSAU. This meter measures flow rate continually. The transfer is a commercial transaction that is documented. CO₂ composition is governed by contract and the gas is routinely sampled. Fluid composition will be determined, at a minimum, quarterly, consistent with EPA GHGRP's Subpart RR, section 98.447(a). All meter and composition data are documented, and records will be retained for at least three years. No CO₂ is received in containers.

6.1.3. CO₂ Injected in the Subsurface

Injected CO₂ will be calculated using the flow meter volumes at the operations meter at the outlet of the RCF and the custody transfer meter at the CO₂ off-take point from the Permian Basin CO₂ pipeline delivery system

6.1.4. CO₂ Produced, Entrained in Products, and Recycled

The following measurements are used for the mass balance equations in Section 7:

CO₂ produced in the gaseous stage is calculated using the volumetric flow meters at the inlet to the RCF.

CO₂ that is entrained in produced oil, as indicated in Figure 3-5, is calculated using volumetric flow through the custody transfer meter.

Recycled CO₂ is calculated using the volumetric flow meter at the outlet of the RCF, which is an operations meter.

6.1.5. CO₂ Emitted by Surface Leakage

Oxy uses 40 CFR Part 98 Subpart W to estimate surface leaks from equipment at the WSSAU. Subpart W uses a factor-driven approach to estimate equipment leakage. In addition, an event-driven process to assess, address, track, and if applicable quantify potential CO₂ leakage to the surface is used. The Subpart W report and results from any event-driven quantification will be reconciled to assure that surface leaks are not double counted.

The multi-layered, risk-based monitoring program for event-driven incidents has been designed to meet two objectives: 1) to detect problems before CO₂ leaks to the surface; and 2) to detect and quantify any leaks that do occur. This section discusses how this monitoring will be conducted and used to quantify the volumes of CO₂ leaked to the surface.

Monitoring for potential Leakage from the Injection/Production Zone:

In addition to the measures discussed in Section 5.9, both injection into and production from the reservoir will be monitored as a means of early identification of potential anomalies that could indicate leakage from the subsurface.

Reservoir simulation modeling, based on extensive history-matched data, is used to develop injection plans (fluid rate, pressure, volume) that are programmed into each WAG satellite. If injection pressure or rate measurements are outside the specified set points determined as part of each pattern injection plan, a data flag is automatically triggered and field personnel will investigate and resolve the problem. These excursions will be reviewed by well management personnel to determine if CO₂ leakage may be occurring. Excursions are not necessarily indicators of leaks; they simply indicate that injection rates and pressures are not conforming to the pattern injection plan. In many cases, problems are straightforward to fix (e.g., a meter needs to be recalibrated or some other minor action is required), and there is no threat of CO₂ leakage. In the case of issues that are not readily resolved, more detailed investigation and response would be initiated, and support staff would provide additional assistance and evaluation. Such issues would lead to the development of a work order in the work order management system. This record enables the tracking of progress on investigating potential leaks and, if a leak has occurred, to quantify its magnitude.

Likewise, a forecast of the rate and composition of produced fluids is developed. Each producer well is assigned to a specific SAT and is isolated during each cycle for a well production test. This data is reviewed on a periodic basis to confirm that production is at the level forecasted. If there is a significant deviation from the plan, well management personnel investigate. If the issue cannot be resolved quickly, more detailed investigation and response would be initiated. As in the case of the injection pattern monitoring, if the investigation leads to a work order in the work order management system, this record will provide the basis for tracking the outcome of the investigation and if a leak has occurred, recording the quantity leaked to the surface. If leakage in the flood zone were detected, an appropriate method would be used to quantify the involved volume of CO₂. This might include use of material balance equations based on known

injected quantities and monitored pressures in the injection zone to estimate the volume of CO₂ involved.

A subsurface leak might not lead to a surface leak. In the event of a subsurface leak, Oxy would determine the appropriate approach for tracking subsurface leakage to determine and quantify leakage to the surface. To quantify leakage, the relevant parameters (e.g., the rate, concentration, and duration of leakage) would be estimated to quantify the leak volume. Depending on specific circumstances, these determinations may rely on engineering estimates.

In the event leakage from the subsurface occurred diffusely through the seals, the leaked gas would include H₂S, which would trigger the alarm on the personal monitors worn by field personnel. Such a diffuse leak from the subsurface has not occurred in the WSSAU. In the event such a leak was detected, personnel would determine how to address the problem. The personnel might use modeling, engineering estimates, and direct measurements to assess, address, and quantify the leakage.

Monitoring of Wellbores:

WSSAU wells are monitored through continual, automated pressure monitoring of the injection zone, monitoring of the annular pressure in wellheads, and routine maintenance and inspection.

Leaks from wellbores would be detected through the follow-up investigation of pressure anomalies, visual inspection, or the use of personal H₂S monitors.

Anomalies in injection zone pressure may not indicate a leak, as discussed above. However, if an investigation leads to a work order, field personnel would inspect the equipment in question and determine the nature of the problem. If it is a simple matter, the repair would be made and the volume of leaked CO₂ would be included in the 40 CFR Part 98 Subpart W report for the WSSAU. If more extensive repair were needed, the appropriate approach for quantifying leaked CO₂ using the relevant parameters (e.g., the rate, concentration, and duration of leakage) would be determined. The work order would serve as the basis for tracking the event for GHG reporting.

Anomalies in annular pressure or other issues detected during routine maintenance inspections would be treated in the same way. Field personnel would inspect the equipment in question and determine the nature of the problem. For simple matters the repair would be made at the time of inspection and the volume of leaked CO₂ would be included in the 40 CFR Part 98 Subpart W report for the WSSAU. If more extensive repairs were needed, the well would be shut in, a work order would be generated and the appropriate approach for quantifying leaked CO₂ using the relevant parameters (e.g., the rate, concentration, and duration of leakage) would be determined. The work order would serve as the basis for tracking the event for GHG reporting.

Because leaking CO₂ at the surface is very cold and leads to formation of bright white clouds and ice that are easily spotted, a visual inspection process in the area of the WSSAU is employed to detect unexpected releases from wellbores. Field personnel visit the surface facilities on a routine basis. Inspections may include tank levels, equipment status, lube oil levels, pressures and flow

rates in the facility, and valves. Field personnel also check that injectors are on the proper WAG schedule and observe the facility for visible CO₂ or fluid line leaks.

Finally, the data collected by the H₂S monitors, which are worn by all field personnel at all times, is used as a last method to detect leakage from wellbores. The H₂S monitors detection limit is 10 ppm; if an H₂S alarm is triggered, the first response is to protect the safety of the personnel, and the next step is to safely investigate the source of the alarm. As noted previously, H₂S is considered a proxy for potential CO₂ leaks in the field. Thus, detected H₂S leaks will be investigated to determine and, if needed, quantify potential CO₂ leakage. If the incident results in a work order, this will serve as the basis for tracking the event for GHG reporting.

Other Potential Leakage at the Surface:

The same visual inspection process and H₂S monitoring system will be used to detect other potential leakage at the surface as it does for leakage from wellbores. Routine visual inspections are used to detect significant loss of CO₂ to the surface. Field personnel routinely visit surface facilities to conduct a visual inspection. Inspections may include review of tank level, equipment status, lube oil levels, pressures and flow rates in the facility, valves, ensuring that injectors are on the proper WAG schedule, and also conducting a general observation of the facility for visible CO₂ or fluid line leaks. If problems are detected, field personnel would investigate, and, if maintenance is required, generate a work order in the maintenance system, which is tracked through completion. In addition to these visual inspections, the results of the personal H₂S monitors worn by field personnel will be used as a supplement for smaller leaks that may escape visual detection.

If CO₂ leakage to the surface is detected, it will be reported to surface operations personnel who will review the reports and conduct a site investigation. If maintenance is required, steps are taken to prevent further leaks, a work order will be generated in the work order management system. The work order will describe the appropriate corrective action and be used to track completion of the maintenance action. The work order will also serve as the basis for tracking the event for GHG reporting and quantifying any CO₂ emissions.

6.1.6. CO₂ emitted from equipment leaks and vented emissions of CO₂ from surface equipment located between the injection flow meter and the injection wellhead

Oxy evaluates and estimates leaks from equipment, the CO₂ content of produced oil, and vented CO₂, as required under 40 CFR Part 98 Subpart W.

6.1.7. CO₂ emitted from equipment leaks and vented emissions of CO₂ from surface equipment located between the production flow meter and the production wellhead

Oxy evaluates and estimates leaks from equipment, the CO₂ content of produced oil, and vented CO₂, as required under 40 CFR Part 98 Subpart W.

6.2. To Demonstrate that Injected CO₂ is not Expected to Migrate to the Surface

At the end of the Specified Period, injecting CO₂ for the subsidiary purpose of establishing the long-term storage of CO₂ in the WSSAU will cease. Some time after the end of the Specified

Period, a request to discontinue monitoring and reporting will be submitted. The request will demonstrate that the amount of CO₂ reported under 40 CFR §98.440-449 (Subpart RR) is not expected to migrate in the future in a manner likely to result in surface leakage. At that time, the request will be supported with years of data collected during the Specified Period as well as two to three (or more, if needed) years of data collected after the end of the Specified Period. This demonstration will provide the information necessary for the EPA Administrator to approve the request to discontinue monitoring and reporting and may include, but is not limited to:

- i. Data comparing actual performance to predicted performance (purchase, injection, production) over the monitoring period;
- ii. An assessment of the CO₂ leakage detected, including discussion of the estimated amount of CO₂ leaked and the distribution of emissions by leakage pathway;
- iii. A demonstration that future operations will not release the volume of stored CO₂ to the surface;
- iv. A demonstration that there has been no significant leakage of CO₂; and,
- v. An evaluation of reservoir pressure that demonstrates that injected fluids are not expected to migrate in a manner to create a potential leakage pathway.

7. Determination of Baselines

Existing automatic data systems will be utilized to identify and investigate excursions from expected performance that could indicate CO₂ leakage. Data systems are used primarily for operational control and monitoring and as such are set to capture more information than is necessary for reporting in the Annual Subpart RR Report. The necessary system guidelines to capture the information that is relevant to identify possible CO₂ leakage will be developed. The following describes the approach to collecting this information.

Visual Inspections

As field personnel conduct routine inspections, work orders are generated in the electronic system for maintenance activities that cannot be addressed on the spot. Methods to capture work orders that involve activities that could potentially involve CO₂ leakage will be developed, if not currently in place. Examples include occurrences of well workover or repair, as well as visual identification of vapor clouds or ice formations. Each incident will be flagged for review by the person responsible for MRV documentation (the responsible party will be provided in the monitoring plan, as required under Subpart A, 98.3(g)). The Annual Subpart RR Report will include an estimate of the amount of CO₂ leaked. Records of information used to calculate emissions will be maintained on file for a minimum of three years.

Personal H₂S Monitors

Oxy's injection gas compositional analysis indicates H₂S is approximately 1% of total injected fluid stream.

H₂S monitors are worn by all field personnel. The H₂S monitors detect concentrations of H₂S up to 500 ppm in 0.1 ppm increments and will sound an alarm if the detection limit exceeds 10ppm. If an H₂S alarm is triggered, the immediate response is to protect the safety of the personnel, and the next step is to safely investigate the source of persistent alarms. Oxy considers H₂S to be a proxy for potential CO₂ leaks in the field. The person responsible for MRV documentation will receive notice of all incidents where H₂S is confirmed to be present. If the incident results in a work order, this will serve as the basis for tracking the event for GHG reporting. The Annual Subpart RR Report will provide an estimate the amount of CO₂ emitted from any such incidents. Records of information to calculate emissions will be maintained on file for a minimum of three years.

Injection Rates, Pressures and Volumes

Target injection rate and pressure for each injector are developed within the permitted limits based on the results of ongoing pattern modeling. The injection targets are programmed into the WAG satellite controllers. High and low set points are also programmed into the controllers, and flags whenever statistically significant deviations from the targeted ranges are identified. The set points are designed to be conservative, because it is preferable to have too many flags rather than too few. As a result, flags can occur frequently and are often found to be insignificant. For purposes of Subpart RR reporting, flags (or excursions) will be screened to determine if they could also lead to CO₂ leakage to the surface. The person responsible for the MRV documentation will receive notice of excursions and related work orders that could potentially involve CO₂ leakage. The Annual Subpart RR Report will provide an estimate of CO₂ emissions. Records of information to calculate emissions will be maintained on file for a minimum of three years.

Production Volumes and Compositions

A general forecast of production volumes and composition is developed which is used to periodically evaluate performance and refine current and projected injection plans and the forecast. This information is used to make operational decisions but is not recorded in an automated data system. Sometimes, this review may result in the generation of a work order in the maintenance system. The MRV plan implementation lead will review such work orders and identify those that could result in CO₂ leakage. Should such events occur, leakage volumes would be calculated following the approaches described in Sections 5 and 6. Impact to Subpart RR reporting will be addressed, if deemed necessary.

8. Determination of Sequestration Volumes Using Mass Balance Equations

To account for the potential propagation of error that would result if volume data from flow meters at each injection and production well were utilized, it is proposed to use the data from custody and operations meters on the main system pipelines to determine injection and production volumes used in the mass balance. This issue arises because while each meter has a small but acceptable margin of error, this error would become significant if data were taken from all of the well head meters within the WSSAU.

The following sections describe how each element of the mass-balance equation (Equation RR-11) will be calculated.

8.1. Mass of CO₂ Received

Equation RR-2 will be used as indicated in Subpart RR §98.443 to calculate the mass of CO₂ at the receiving custody transfer meter from the Permian Basin CO₂ pipeline delivery system. The volumetric flow at standard conditions will be multiplied by the CO₂ concentration and the density of CO₂ at standard conditions to determine mass.

$$CO_{2T,r} = \sum_{p=1}^4 (Q_{p,r} - S_{r,p}) * D * C_{CO_2,r,p} \quad (\text{Eq. RR-2})$$

where:

$CO_{2T,r}$ = Net annual mass of CO₂ received through flow meter r (metric tons).

$Q_{r,p}$ = Quarterly volumetric flow through a receiving flow meter r in quarter p at standard conditions (standard cubic meters).

$S_{r,p}$ = Quarterly volumetric flow through a receiving flow meter r that is redelivered to another facility without being injected into a site well in quarter p (standard cubic meters).

D = Density of CO₂ at standard conditions (metric tons per standard cubic meter): 0.0018682.

$C_{CO_2,r,p}$ = Quarterly CO₂ concentration measurement in flow for flow meter r in quarter p (vol. percent CO₂, expressed as a decimal fraction).

p = Quarter of the year.

r = Receiving flow meters.

Given WSSAU's method of receiving CO₂ and requirements at Subpart RR §98.444(a):

- All delivery to the WSSAU is used within the unit so no quarterly flow redelivered, and $S_{r,p}$ will be zero ("0").
- Quarterly CO₂ concentration will be taken from the gas measurement database

8.2. Mass of CO₂ Injected into the Subsurface

The equation for calculating the Mass of CO₂ Injected into the Subsurface at the WSSAU is equal to the sum of the Mass of CO₂ Received as calculated in RR-2 of §98.443 (section 8.1 above) and

the Mass of CO₂ Recycled calculated using measurements taken from the flow meter located at the output of the RCF (see Figure 3-5). As previously explained, using data at each injection well would give an inaccurate estimate of total injection volume due to the large number of wells and the potential for propagation of error due to allowable calibration ranges for each meter.

The Mass of CO₂ Recycled will be determined using equations RR-5 as follows:

$$CO_{2u} = \sum_{p=1}^4 Q_{p,u} * D * C_{CO_2,p,u} \quad (\text{Eq. RR-5})$$

where:

CO_{2u} = Annual CO₂ mass recycled (metric tons) as measured by flow meter u.

Q_{p,u} = Quarterly volumetric flow rate measurement for flow meter u in quarter p at standard conditions (standard cubic meters per quarter).

D = Density of CO₂ at standard conditions (metric tons per standard cubic meter): 0.0018682.

C_{CO₂,p,u} = CO₂ concentration measurement in flow for flow meter u in quarter p (vol. percent CO₂, expressed as a decimal fraction).

p = Quarter of the year.

u = Flow meter.

The total Mass of CO₂ Injected will be the sum of the Mass of CO₂ Received (RR-3) and Mass of CO₂ Recycled (modified RR-5).

$$CO_{2I} = CO_2 + CO_{2u}$$

8.3. Mass of CO₂ Produced

The Mass of CO₂ Produced at the WSSAU will be calculated using the measurements from the flow meters at the inlet to RCF and the custody transfer meter for oil sales rather than the metered data from each production well. Again, using the data at each production well would give an inaccurate estimate of total injection due to the large number of wells and the potential for propagation of error due to allowable calibration ranges for each meter.

Equation RR-8 in §98.443 will be used to calculate the Mass of CO₂ Produced from all production wells as follows:

$$CO_{2w} = \sum_{p=1}^4 Q_{p,w} * D * C_{CO_2,p,w} \quad (\text{Eq. RR-8})$$

Where:

CO_{2w} = Annual CO₂ mass produced (metric tons) .

Q_{p,w} = Volumetric gas flow rate measurement for meter w in quarter p at standard conditions (standard cubic meters).

D = Density of CO₂ at standard conditions (metric tons per standard cubic meter):
0.0018682.

C_{CO₂,p,w} = CO₂ concentration measurement in flow for meter w in quarter p (vol. percent
CO₂, expressed as a decimal fraction).

p = Quarter of the year.

w = inlet meter to RCF.

For Equation RR-9 in §98.443 the variable X_{oil} will be measured as follows:

$$CO_{2p} = \sum_{w=1}^w CO_{2w} + X_{oil} \quad (\text{Eq. RR-9})$$

Where:

CO_{2p} = Total annual CO₂ mass produced (metric tons) through all meters in the reporting
year.

CO_{2w} = Annual CO₂ mass produced (metric tons) through meter w in the reporting year.

X_{oil} = Mass of entrained CO₂ in oil in the reporting year measured utilizing commercial
meters and electronic flow-measurement devices at each point of custody transfer.
The mass of CO₂ will be calculated by multiplying the total volumetric rate by the
CO₂ concentration.

8.4. Mass of CO₂ Emitted by Surface Leakage

The total annual Mass of CO₂ emitted by Surface Leakage will be calculated and reported using an approach that is tailored to specific leakage events and relies on 40 CFR Part 98 Subpart W reports of equipment leakage. Oxy is prepared to address the potential for leakage in a variety of settings. Estimates of the amount of CO₂ leaked to the surface will depend on a number of site-specific factors including measurements, engineering estimates, and emission factors, depending on the source and nature of the leakage.

The process for quantifying leakage will entail using best engineering principles or emission factors. While it is not possible to predict in advance the types of leaks that will occur, some approaches for quantification are described in Sections 5.9 and 6. In the event leakage to the surface occurs, leakage amounts would be quantified and reported, and records that describe the methods used to estimate or measure the volume leaked as reported in the Annual Subpart RR Report would be retained. Further, the Subpart W report and results from any event-driven quantification will be reconciled to assure that surface leaks are not double counted.

Equation RR-10 in 48.433 will be used to calculate and report the Mass of CO₂ emitted by Surface Leakage:

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

where:

CO_{2E} = Total annual CO₂ mass emitted by surface leakage (metric tons) in the reporting year.

CO_{2x} = Annual CO₂ mass emitted (metric tons) at leakage pathway x in the reporting year.

x = Leakage pathway.

8.5. Mass of CO₂ Sequestered in Subsurface Geologic Formation

Equation RR-11 in 98.443 will be used to calculate the Mass of CO₂ Sequestered in Subsurface Geologic Formations in the Reporting Year as follows:

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

where:

CO₂ = Total annual CO₂ mass sequestered in subsurface geologic formations (metric tons) at the facility in the reporting year.

CO_{2I} = Total annual CO₂ mass injected (metric tons) in the well or group of wells covered by this source category in the reporting year.

CO_{2P} = Total annual CO₂ mass produced (metric tons) net of CO₂ entrained in oil in the reporting year.

CO_{2E} = Total annual CO₂ mass emitted (metric tons) by surface leakage in the reporting year.

CO_{2FI} = Total annual CO₂ mass emitted (metric tons) from equipment leaks and vented emissions of CO₂ 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 CO₂ mass emitted (metric tons) from equipment leaks and vented emissions of CO₂ 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.

8.6. Cumulative Mass of CO₂ Reported as Sequestered in Subsurface Geologic Formation

The total annual volumes obtained using equation RR-11 in 98.443 will be summed to arrive at the Cumulative Mass of CO₂ Sequestered in Subsurface Geologic Formations.

9. MRV Plan Implementation Schedule

This MRV plan will be implemented starting January 2021 or within 90 days of EPA approval, whichever occurs later. Other GHG reports are filed on March 31 of the year after the reporting year and it is anticipated that the Annual Subpart RR Report will be filed at the same time. It is anticipated that the MRV program will be in effect during the Specified Period, during which time the WSSAU will be operated with the subsidiary purpose of establishing long-term containment of a measurable quantity of CO₂ in subsurface geological formations at the WSSAU. It is anticipated to establish that a measurable amount of CO₂ injected during the Specified Period will be stored in a manner not expected to migrate resulting in future surface leakage. At such time, a demonstration supporting the long-term containment determination will be prepared and a request to discontinue monitoring and reporting under this MRV plan will be submitted. *See* 40 C.F.R. § 98.441(b)(2)(ii).

10. Quality Assurance Program

10.1. Monitoring QA/QC

The requirements of §98.444 (a) – (d) have been incorporated in the discussion of mass balance equations. These include the following provisions.

CO₂ Received and Injected

- The quarterly flow rate of CO₂ received by pipeline is measured at the receiving custody transfer meters.
- The quarterly CO₂ flow rate for recycled CO₂ is measured at the flow meter located at the RCF outlet.

CO₂ Produced

- The point of measurement for the quantity of CO₂ produced from oil or other fluid production wells is a flow meter directly downstream of each separator that sends a stream of gas into a recycle or end use system.
- The produced gas stream is sampled at least once per quarter immediately downstream of the flow meter used to measure flow rate of that gas stream and measure the CO₂ concentration of the sample.
- The quarterly flow rate of the produced gas is measured at the flow meters located at the RCF inlet.

CO₂ emissions from equipment leaks and vented emissions of CO₂

These volumes are measured in conformance with the monitoring and QA/QC requirements specified in subpart W of 40 CFR Part 98.

Flow meter provisions

The flow meters used to generate data for the mass balance equations are:

- Operated continuously except as necessary for maintenance and calibration.
- Operated using the calibration and accuracy requirements in 40 CFR §98.3(i).
- Operated in conformance with American Petroleum Institute (API) standards.
- National Institute of Standards and Technology (NIST) traceable.

Concentration of CO₂

CO₂ concentration is measured using an appropriate standard method. Further, all measured volumes of CO₂ have been converted to standard cubic meters at a temperature of 60 degrees Fahrenheit and at an absolute pressure of 1 atmosphere, including those used in Equations RR-2, RR-5 and RR-8 in Section 8.

10.2. Missing Data Procedures

In the event data needed for the mass balance calculations cannot be collected, procedures for estimating missing data in §98.445 will be used as follows:

- A quarterly flow rate of CO₂ received that is missing would be estimated using invoices or using a representative flow rate value from the nearest previous time period.

- A quarterly CO₂ concentration of a CO₂ stream received that is missing would be estimated using invoices or using a representative concentration value from the nearest previous time period.
- A quarterly quantity of CO₂ injected that is missing would be estimated using a representative quantity of CO₂ injected from the nearest previous period of time at a similar injection pressure.
- For any values associated with CO₂ emissions from equipment leaks and vented emissions of CO₂ from surface equipment at the facility that are reported in this subpart, missing data estimation procedures specified in subpart W of 40 CFR Part 98 would be followed.
- The quarterly quantity of CO₂ produced from subsurface geologic formations that is missing would be estimated using a representative quantity of CO₂ produced from the nearest previous period of time.

10.3. MRV Plan Revisions

In the event there is a material change to the monitoring and/or operational parameters of the CO₂ EOR operations in the WSSAU that is not anticipated in this MRV plan, the MRV plan will be revised and submitted to the EPA Administrator within 180 days as required in §98.448(d).

11. Records Retention

The record retention requirements specified by §98.3(g) will be followed. In addition, the requirements in Subpart RR §98.447 will be met by maintaining the following records for at least three years:

- Quarterly records of CO₂ received at standard conditions and operating conditions, operating temperature and pressure, and concentration of these streams.
- Quarterly records of produced CO₂, including volumetric flow at standard conditions and operating conditions, operating temperature and pressure, and concentration of these streams.
- Quarterly records of injected CO₂ including volumetric flow at standard conditions and operating conditions, operating temperature and pressure, and concentration of these streams.
- Annual records of information used to calculate the CO₂ emitted by surface leakage from leakage pathways.
- Annual records of information used to calculate the CO₂ emitted from equipment leaks and vented emissions of CO₂ from equipment located on the surface between the flow meter used to measure injection quantity and the injection wellhead.
- Annual records of information used to calculate the CO₂ emitted from equipment leaks and vented emissions of CO₂ from equipment located on the surface between the production wellhead and the flow meter used to measure production quantity.

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

12. Appendix

12.1 Well Identification Numbers

The following table presents the well name and number, API number, type, and status for active wells in WSSAU as of September 2020. The table is subject to change over time as new wells are drilled, existing wells change status, or existing wells are repurposed. The following terms are used:

- Well Status
 - ACTIVE refers to active wells
 - DRILL refers to wells under construction
 - TA refers to wells that have been temporarily abandoned
 - SHUT_IN refers to wells that have been temporarily idled or shut-in
 - INACTIVE refers to wells that have been completed but are not in use
- Well Type
 - DISP_H2O refers to wells for water disposal
 - INJ_GAS refers to wells that inject CO₂ Gas
 - INJ_WAG refers to wells that inject water and CO₂ Gas
 - INJ_H2O refers to wells that inject water
 - OBSERVATION refers to observation or monitoring wells
 - PROD_GAS refers to wells that produce natural gas
 - PROD_OIL refers to wells that produce oil
 - SUP_H2O refers to wells that supply water

• Well Name & Number	API Number	Well Type	Well Status as of September 2020
WSSAU-0002WD	4216500675	DISP_H2O	ACTIVE
WSSAU-0101	4216501591	PROD_OIL	TA
WSSAU-0104	4216532613	INJ_H2O	ACTIVE
WSSAU-0201	4216500642	PROD_OIL	ACTIVE
WSSAU-0202	4216500643	PROD_OIL	ACTIVE
WSSAU-0203	4216500645	PROD_OIL	TA
WSSAU-0207	4216534204	PROD_OIL	ACTIVE
WSSAU-0208	4216537800	PROD_OIL	ACTIVE
WSSAU-0209	4216537801	PROD_OIL	ACTIVE
WSSAU-0210	4216537802	PROD_OIL	ACTIVE
WSSAU-0211	4216537803	PROD_OIL	ACTIVE
WSSAU-0212	4216538559	PROD_OIL	ACTIVE
WSSAU-0213	4216538558	PROD_OIL	ACTIVE
WSSAU-0214	4216538557	PROD_OIL	ACTIVE
WSSAU-0301R	4216538445	PROD_OIL	ACTIVE
WSSAU-0302R	4216538446	PROD_OIL	ACTIVE

WSSAU-0303	4216500644	PROD_OIL	ACTIVE
WSSAU-0303R	4216538447	PROD_OIL	ACTIVE
WSSAU-0304R	4216538448	PROD_OIL	ACTIVE
WSSAU-0305RW	4216538449	INJ_WAG	ACTIVE
WSSAU-0305W	4216530388	INJ_H2O	TA
WSSAU-0306RW	4216538450	INJ_WAG	ACTIVE
WSSAU-0307RW	4216538451	INJ_WAG	ACTIVE
WSSAU-0309	4216531624	INJ_WAG	ACTIVE
WSSAU-0310	4216531626	INJ_WAG	ACTIVE
WSSAU-0311RW	4216537493	INJ_WAG	ACTIVE
WSSAU-0312	4216531743	PROD_OIL	ACTIVE
WSSAU-0313	4216531744	PROD_OIL	ACTIVE
WSSAU-0314	4216531745	PROD_OIL	ACTIVE
WSSAU-0315	4216531787	INJ_H2O	INACTIVE
WSSAU-0316W	4216531786	INJ_H2O	ACTIVE
WSSAU-0317W	4216531790	INJ_H2O	INACTIVE
WSSAU-0318W	4216531788	INJ_H2O	ACTIVE
WSSAU-0319	4216531789	INJ_H2O	INACTIVE
WSSAU-0320	4216531838	PROD_OIL	ACTIVE
WSSAU-0321	4216531837	INJ_WAG	ACTIVE
WSSAU-0322	4216532404	INJ_WAG	ACTIVE
WSSAU-0323	4216532405	INJ_WAG	ACTIVE
WSSAU-0324	4216532566	INJ_WAG	ACTIVE
WSSAU-0325	4216534144	PROD_OIL	ACTIVE
WSSAU-0326	4216534203	INJ_WAG	ACTIVE
WSSAU-0327	4216538560	INJ_WAG	ACTIVE
WSSAU-0328	4216538561	INJ_WAG	ACTIVE
WSSAU-0329	4216538562	INJ_WAG	ACTIVE
WSSAU-0330	4216538563	INJ_WAG	ACTIVE
WSSAU-03WD	4216538439	DISP_H2O	ACTIVE
WSSAU-0401	4216501587	PROD_OIL	ACTIVE
WSSAU-0404	4216501590	PROD_OIL	TA
WSSAU-0405RW	4216538452	INJ_WAG	ACTIVE
WSSAU-0406	4216531978	INJ_H2O	ACTIVE
WSSAU-0407	4216531979	PROD_OIL	TA
WSSAU-0408	4216534205	INJ_H2O	ACTIVE
WSSAU-0409	4216538556	PROD_OIL	ACTIVE
WSSAU-0410	4216538550	INJ_WAG	ACTIVE

WSSAU-0411	4216538571	INJ_WAG	ACTIVE
WSSAU-0412	4216538583	INJ_WAG	ACTIVE
WSSAU-0413	4216538572	INJ_WAG	ACTIVE
WSSAU-0414	4216538573	INJ_WAG	ACTIVE
WSSAU-0415	4216538585	PROD_OIL	ACTIVE
WSSAU-0416	4216538586	PROD_OIL	ACTIVE
WSSAU-0417	4216538574	PROD_OIL	ACTIVE
WSSAU-0418	4216538580	PROD_OIL	ACTIVE
WSSAU-0419	4216538582	PROD_OIL	ACTIVE
WSSAU-0501	4216500657	PROD_GAS	TA
WSSAU-0502	4216500610	PROD_OIL	ACTIVE
WSSAU-0503W	4216500604	INJ_H2O	ACTIVE
WSSAU-0504W	4216500625	INJ_H2O	ACTIVE
WSSAU-0505	4216581090	PROD_OIL	ACTIVE
WSSAU-0507	4216532609	PROD_OIL	TA
WSSAU-0508	4216534225	INJ_H2O	ACTIVE
WSSAU-0509	4216537203	PROD_OIL	ACTIVE
WSSAU-0601	4216500663	PROD_OIL	ACTIVE
WSSAU-0602R	4216538300	PROD_OIL	ACTIVE
WSSAU-0603	4216500665	PROD_OIL	ACTIVE
WSSAU-0603R	4216538404	PROD_OIL	ACTIVE
WSSAU-0604	4216500666	PROD_OIL	TA
WSSAU-0604R	4216538299	PROD_OIL	ACTIVE
WSSAU-0605	4216500667	PROD_OIL	TA
WSSAU-0605R	4216538298	PROD_OIL	ACTIVE
WSSAU-0606	4216500629	INJ_GAS	SHUT-IN
WSSAU-0607	4216500630	PROD_OIL	ACTIVE
WSSAU-0607R	4216538405	PROD_OIL	ACTIVE
WSSAU-0608	4216500631	PROD_OIL	ACTIVE
WSSAU-0609RW	4216538403	INJ_WAG	ACTIVE
WSSAU-0609W	4216530214	INJ_H2O	ACTIVE
WSSAU-0610RW	4216538402	INJ_WAG	ACTIVE
WSSAU-0611RW	4216538401	INJ_WAG	ACTIVE
WSSAU-0611W	4216530279	INJ_H2O	ACTIVE
WSSAU-0613	4216530531	PROD_OIL	ACTIVE
WSSAU-0614	4216531632	PROD_OIL	ACTIVE
WSSAU-0615	4216531630	PROD_OIL	ACTIVE
WSSAU-0616	4216531627	INJ_WAG	ACTIVE

WSSAU-0617	4216531629	PROD_GAS	TA
WSSAU-0617RW	4216537492	INJ_WAG	ACTIVE
WSSAU-0618	4216531628	INJ_WAG	ACTIVE
WSSAU-0619	4216531836	PROD_OIL	ACTIVE
WSSAU-0620	4216531835	PROD_OIL	ACTIVE
WSSAU-0621	4216531834	INJ_H2O	ACTIVE
WSSAU-0622	4216531833	PROD_OIL	ACTIVE
WSSAU-0623	4216531832	PROD_OIL	ACTIVE
WSSAU-0624	4216531831	PROD_OIL	ACTIVE
WSSAU-0625	4216531980	PROD_OIL	ACTIVE
WSSAU-0626	4216532403	PROD_OIL	ACTIVE
WSSAU-0627	4216532402	PROD_OIL	ACTIVE
WSSAU-0701	4216500633	PROD_OIL	ACTIVE
WSSAU-0702	4216500635	PROD_OIL	ACTIVE
WSSAU-0703	4216500637	PROD_OIL	ACTIVE
WSSAU-0704	4216500613	PROD_OIL	ACTIVE
WSSAU-0705	4216500612	PROD_OIL	ACTIVE
WSSAU-0706	4216500641	PROD_OIL	TA
WSSAU-0707RW	4216538453	INJ_WAG	ACTIVE
WSSAU-0708RW	4216538454	INJ_WAG	ACTIVE
WSSAU-0708W	4216530392	INJ_H2O	ACTIVE
WSSAU-0712	4216531981	INJ_H2O	ACTIVE
WSSAU-0713	4216531982	INJ_H2O	ACTIVE
WSSAU-0714	4216532299	INJ_H2O	ACTIVE
WSSAU-0715	4216532406	PROD_OIL	TA
WSSAU-0716	4216532567	PROD_OIL	ACTIVE
WSSAU-0717	4216534023	PROD_OIL	ACTIVE
WSSAU-0801	4216500634	PROD_OIL	TA
WSSAU-0802	4216500636	PROD_OIL	ACTIVE
WSSAU-0803	4216500638	PROD_OIL	ACTIVE
WSSAU-0804W	4216500639	INJ_H2O	ACTIVE
WSSAU-0805	4216500640	PROD_OIL	ACTIVE
WSSAU-0809	4216532595	PROD_OIL	ACTIVE
WSSAU-0810	4216532612	PROD_OIL	ACTIVE
WSSAU-0811	4216538581	PROD_OIL	ACTIVE
WSSAU-0812	4216538587	PROD_OIL	ACTIVE
WSSAU-0901W	4216500498	INJ_H2O	ACTIVE
WSSAU-0902W	4216500500	INJ_H2O	ACTIVE

WSSAU-1102W	4216500632	INJ_H2O	SHUT-IN
WSSAU-1103W	4216530285	INJ_H2O	INACTIVE
WSSAU-1105	4216531401	PROD_GAS	TA
WSSAU-1106	4216537204	SUP_H2O	TA
WSSAU-1201	4216502768	PROD_OIL	ACTIVE
WSSAU-1202R	4216538406	PROD_OIL	ACTIVE
WSSAU-1203	4216502750	PROD_OIL	ACTIVE
WSSAU-1204	4216502771	PROD_OIL	ACTIVE
WSSAU-1206RW	4216538400	INJ_WAG	ACTIVE
WSSAU-1207RW	4216538399	INJ_WAG	ACTIVE
WSSAU-1207W	4216530291	INJ_H2O	INACTIVE
WSSAU-1208RW	4216538398	INJ_WAG	ACTIVE
WSSAU-1209	4216531977	INJ_H2O	ACTIVE
WSSAU-1210	4216531976	INJ_WAG	ACTIVE
WSSAU-1211	4216531983	PROD_OIL	TA
WSSAU-1211RW	4216537491	INJ_WAG	ACTIVE
WSSAU-1212	4216531985	INJ_WAG	ACTIVE
WSSAU-1213	4216531984	PROD_OIL	ACTIVE
WSSAU-1214	4216531974	PROD_OIL	ACTIVE
WSSAU-1215	4216531975	PROD_OIL	ACTIVE
WSSAU-1216	4216531986	PROD_OIL	ACTIVE
WSSAU-1302	4216500661	PROD_OIL	SHUT-IN
WSSAU-1303	4216500626	PROD_OIL	TA
WSSAU-1304	4216500627	PROD_OIL	ACTIVE
WSSAU-1305W	4216530090	INJ_H2O	SHUT-IN
WSSAU-1309	4216532298	INJ_H2O	ACTIVE
WSSAU-1310	4216532297	INJ_H2O	ACTIVE
WSSAU-1311	4216532303	INJ_H2O	ACTIVE
WSSAU-1312	4216532302	INJ_H2O	ACTIVE
WSSAU-1313	4216532301	PROD_OIL	TA
WSSAU-1315	4216532304	PROD_OIL	ACTIVE
WSSAU-1316	4216532305	PROD_OIL	ACTIVE
WSSAU-1401	4216581121	PROD_OIL	SHUT-IN
WSSAU-1402	4216500504	PROD_OIL	TA
WSSAU-1403	4216581123	PROD_OIL	ACTIVE
WSSAU-1405W	4216530401	INJ_H2O	SHUT-IN
WSSAU-1406W	4216530400	INJ_H2O	INACTIVE
WSSAU-1407	4216530508	PROD_OIL	ACTIVE

WSSAU-1408	4216530552	PROD_OIL	ACTIVE
WSSAU-1409	4216534022	PROD_OIL	ACTIVE
WSSAU-1410	4216534145	PROD_OIL	TA
WSSAU-1502	4216501300	PROD_OIL	ACTIVE
WSSAU-1503	4216500497	PROD_OIL	ACTIVE
WSSAU-1504W	4216500499	INJ_H2O	SHUT-IN
WSSAU-1505	4216530550	PROD_OIL	ACTIVE
WSSAU-1506W	4216534146	INJ_H2O	ACTIVE
WSSAU-1601W	4216501392	INJ_H2O	SHUT-IN
WSSAU-1901	4216501464	PROD_OIL	TA
WSSAU-1902W	4216501466	INJ_H2O	INACTIVE
WSSAU-1903	4216538549	PROD_OIL	TA
WSSAU-2101W	4216502546	INJ_H2O	TA
WSSAU-2102W	4216502544	INJ_H2O	TA

12.2 Regulatory References

Regulations cited in this plan:

- i. Texas Administrative Code Title 16 Part 1 Chapter 3 Oil & Gas Division - [https://texreg.sos.state.tx.us/public/readtac\\$ext.ViewTAC?tac_view=4&ti=16&pt=1&ch=3&rl=Y](https://texreg.sos.state.tx.us/public/readtac$ext.ViewTAC?tac_view=4&ti=16&pt=1&ch=3&rl=Y)
- ii. TRRC Injection/Disposal Well Permitting, Testing and Monitoring Manual - <https://www.rrc.state.tx.us/oil-gas/publications-and-notices/manuals/injectiondisposal-well-manual/>