UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
AIR AND RADIATION

August 21, 2023

Ms. Margrethe Berge
Seminole San Andres Unit
5 Greenway Plaza
Suite 110
Houston, Texas 77046

Re: Monitoring, Reporting and Verification (MRV) Plan for Seminole San Andres Unit

Dear Ms. Berge:

The United States Environmental Protection Agency (EPA) has reviewed the Monitoring, Reporting and Verification (MRV) Plan submitted for Seminole San Andres Unit, as required by 40 CFR Part 98, Subpart RR of the Greenhouse Gas Reporting Program. The EPA is approving the MRV Plan submitted by Seminole San Andres Unit on July 20, 2023, as the final MRV plan. The MRV Plan Approval Number is 1009861-1. This decision is effective August 26, 2023 and is appealable to the EPA's Environmental Appeals Board under 40 CFR Part 78. In conjunction with this MRV plan approval, we recommend reviewing the subpart PP regulations to determine whether your facility may also be required to report data as a supplier of carbon dioxide.

If you have any questions regarding this determination, please contact me or Melinda Miller of the Greenhouse Gas Reporting Branch at miller.melinda@epa.gov.

Sincerely,

Julius Banks, Chief
Greenhouse Gas Reporting Branch

Technical Review of Subpart RR MRV Plan for Seminole San Andres Unit (SSAU)

August 2023

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This document summarizes the U.S. Environmental Protection Agency's (EPA's) technical evaluation of the Greenhouse Gas Reporting Program (GHGRP) Subpart RR Monitoring, Reporting, and Verification (MRV) plan submitted by OXY USA, INC.'s (OXY) Seminole San Andres Unit (SSAU) for its carbon dioxide (CO_2)-enhanced oil recovery (EOR) project located in the Permian-aged SSAU field in West Texas. Note that this evaluation pertains only to the Subpart RR MRV plan, and does not in any way replace, remove, or affect Underground Injection Control (UIC) permitting obligations. Furthermore, this decision is applicable only to the MRV plan and does not constitute an EPA endorsement of the project, technologies, or parties involved.

1 Overview of Project

As described in the MRV plan, OXY currently operates a CO_2-EOR project in the SSAU located in West Texas for the primary purpose of enhanced oil recovery using CO_2, with retention of CO_2 serving as a subsidiary purpose of geologic sequestration of CO_2 in a subsurface geologic formation. The producing formation, which contains the sequestration zone, is the San Andres Formation. While the SSAU began producing oil in 1941, the MRV plan states that CO_2 flooding was initiated in 1983. Under this MRV plan, SSAU plans to inject approximately 532 million metric tons (MMT) of CO_2 over the duration of the project from 2022 through 2055. 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 CO_2 sequestered at the SSAU.

The MRV plan states that all EOR injection wells in the SSAU are currently classified as Underground Injection Control (UIC) Class II wells permitted by the Texas Railroad Commissions (TRRC). TRRC has primacy to implement the UIC Class II program in the state for injection wells. Wells in the SSAU are identified by name, American Petroleum Institute (API) number, type, and status. Section 12 of the MRV plan contains a list of wells in the SSAU as of February 2022. The MRV plan also states that SSAU recognizes that all changes to wells within the SSAU must be included in the Subpart RR Annual Report.

As stated in the MRV plan, the SSAU is located in the Permian Basin on the northeast portion of the Central Basin Platform in West Texas. The productive interval, or reservoir, is within the San Andres Formation and is composed of layers of permeable dolomites that were deposited in a shallow marine environment during the Permian Period, approximately 250 to 300 million years ago. The MRV plan also states that the overlying confining system consists of non-porous anhydritic strata that are approximately 2,770 feet (ft) thick. The confining system can further be divided into three sub-zones: an approximately 95 ft thick primary confining layer between the top of sequestration zone and top of the San Andres Formation; an approximately 200 ft thick secondary confining layer between the San Andres Formation and Grayburg Formation; and an approximately 2,350 ft thick tertiary confining layer from the Grayburg Formation to the Rustler Formation. The MRV plan also states that there are numerous relatively thin layers that provide additional containment between the sequestration zone and freshwater aquifers found at a depth of 250 feet. These layers are comprised of siltstones, shales, salts, and anhydrite sequences with little to no porosity or permeability.

The MRV plan states that the SSAU is a dome structure draped over a fault-bounded, doubly plunging anticline that tips out in Devonian strata where several N-NW trending seismically resolvable faults have been identified and mapped. The elevated area forms a natural trap for oil and gas that migrated upward from deeper source rocks over millions of years. The faults are situated southwest of the structural crest, with a maximum offset of 1,800 ft within Devonian strata and tip out approximately 1,700 ft below the SSAU sequestration zone. SSAU claims that they extensively analyzed seismic data acquired over the SSAU to assess potential leakage pathways and basement-rooted faults. The MRV plan also states that SSAU determined that seismic attributes, such as coherence, do not reveal linear discontinuities beyond those currently mapped. Likewise, SSAU found that downhole measurements from profile logs and micro-resistivity imaging tools show no indication of conductive faults or fractures. Pressure-based interference tests and simulation-based history matching also indicate that reservoir behavior has not been modified by faults and fractures.

According to the MRV plan, CO_2 is delivered to the SSAU via the Permian Basin CO_2 pipeline network from several different sources. The mass of CO_2 received at both units is metered and calculated through the custody transfer meter (M2) located at the pipeline delivery point. The mass of CO_2 received is combined with recycled CO_2 from the Seminole Gas Processing Plant (SGPP) (M3) and distributed to the CO_2 trunklines for injection according to a pre-programmed injection plan for each well pattern, which alternates between water and CO_2 injection.

The MRV plan states that SSAU forecasts to inject 532 MMT CO_2 across the entire unit from 2022 to 2055. Of this 532 MMT of CO_2, 358 MMT of CO_2 is forecasted to be produced and 174 MMT of CO_2 is forecasted to be stored. For operations up until 2021, the MRV plan states that 115 MMT of CO_2 were stored and 109 MMT of CO_2 were produced and reinjected. The MRV plan also states that the total stored CO_2 from previous EOR operations and the planned sequestered mass of 174 MMT will account for approximately 57% of the total pore volume (total pore volume equals 5,816 million reservoir barrels (MMRB) or 509 MMT calculated for the SSAU). Additionally, reservoir pressure in the SSAU is managed by maintaining an injection-to-withdrawal ratio (IWR) of approximately 1.0. 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.

The description of the project provides the necessary information for 40 CFR 98.448(a)(6).

2 Evaluation of the Delineation of the Maximum Monitoring Area (MMA) and Active Monitoring Area (AMA)

As part of the MRV plan, the reporter must identify and delineate both the maximum monitoring area (MMA) and active monitoring area (AMA), pursuant to 40 CFR 98.448(a)(1). Subpart RR defines maximum monitoring area as “the area that must be monitored under this regulation and is defined as equal to or greater than the area expected to contain the free phase CO_2 plume until the CO_2 plume has stabilized plus an all-around buffer zone of at least one-half mile.” Subpart RR defines active monitoring area as “the area that will be monitored over a specific time interval from the first year of the period (n) to the last year in the period (t). The boundary of the active monitoring area is established by superimposing two areas: (1) the area projected to contain the free phase CO_2 plume at the end of year t, plus an all-around buffer zone of one-half mile or greater if known leakage pathways extend laterally more than one-half mile; (2) the area projected to contain the free phase CO_2 plume at the end of year t + 5." See 40 CFR 98.449.

The MRV plan states that a history-matched reservoir model of the current and forecasted SSAU CO_2 injection plan was constructed using tNavigator, which is a commercially available reservoir simulation software program. The model simulates the recovery mechanism in which CO_2 is miscible with the hydrocarbon phase in the reservoir. The MRV plan explains that the model was created to demonstrate that the storage complex has, at a minimum, the capacity to contain the planned mass of injected CO_2 and to also track injected CO_2, identify how and where CO_2 is trapped in the SSAU, and monitor sequestration mass and distribution. The reservoir model utilizes four main types of data: site characteristics as described in the SSAU geomodel; initial reservoir conditions and fluid property data; capillary pressure data; and well data.

The MRV plan states that SSAU used the reservoir model to evaluate the plume of CO_2 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 the uncertainty of any specific variable will have a meaningful impact on the reservoir's CO_2 storage performance. The model forecast shows that CO_2 will be contained in the reservoir within the boundaries of the SSAU.

As stated in Section 4 of the MRV plan, SSAU defines the AMA as the SSAU plus the required ½-mile buffer 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).

The MRV plan states that the AMA determination is supported by project design and site geology as follows:

- SSAU operates injector and producer wells throughout the SSAU.
- CO_2 injected into the SSAU remains contained within the SSAU because of SSAU's fluid and pressure management practices, i.e., the maintained IWR of 1.0 is consistent with stable reservoir pressure. Managed lease line injection and production wells are used to retain fluids, and operational results confirm that the injected CO_2 is retained within the SSAU.
- The SSAU is a structural high within the formation, therefore CO_2will migrate up-dip within the SSAU to the structurally highest position and be retained by the geologic confining unit. CO_2 will not migrate downdip.

The MRV plan states that the MMA is defined by the boundary of the SSAU plus the required ½-mile buffer. The maximum extent of the CO_2 plume after it has stabilized will be contained within the SSAU, therefore the SSAU boundary plus a ½ mile buffer is consistent with the definition in 40 CFR 98.449. The MRV plan describes that after operations cease, the CO_2 plume is projected to remain within the SSAU due to the presence of a structural trap, a competent confining zone that has remained sealed for millions of years, sufficient pore space, and the use of IWR of approximately 1.0.

Section 4 of the MRV plan also states that the primary purpose for injecting CO_2 is to produce oil that would otherwise remain trapped in the reservoir. During a specified period, there will be a subsidiary purpose of establishing the long-term containment of CO_2 in the SSAU. The specified period will be shorter than the period of production from the SSAU.

The delineations of the MMA and AMA are acceptable per the requirements in 40 CFR 98.448(a)(1). The MMA and AMA described in the MRV plan are clearly delineated in the plan and are consistent with the definitions in 40 CFR 98.449.

3 Identification of Potential Surface Leakage Pathways

As part of the MRV plan, the reporter must identify potential surface leakage pathways for CO_2 in the MMA, and that the likelihood, magnitude, and timing of surface leakage of CO_2 through these pathways pursuant to 40 CFR 98.448(a)(2). SSAU identified the following as potential leakage pathways in their MRV plan that required consideration:

1. Existing Wellbores
2. Faults and Fractures
3. Natural and Induced Seismic Activity
4. Previous Operations
5. Pipeline/Surface Equipment
6. Lateral Migration Outside the SSAU
7. Drilling Through the CO_2 Area
8. Diffuse Leakage Through the Seal

3.1 Leakage through Existing Wellbores

According to the MRV plan, an extensive review of all SSAU penetrations was completed to determine the potential need for corrective action. This analysis showed that all penetrations have either been adequately plugged and abandoned or, if in use, do not require corrective action. The MRV plan also states that all wells in the SSAU were constructed and are operated in compliance with TRRC rules. As part of routine risk management, SSAU identified and evaluated the potential risk of CO_2 wellbore leakage occurring through CO_2 flood beam-pumped producing wells, electrical submersible pump (ESP) producer wells, naturally flowing producer wells, hydraulic jet pump producer wells, CO_2 Water Alternating Gas (WAG) injector wells, and water injectors.

The risk assessment, as described in the MRV plan, classified the risk associated with leakage occurring through existing wellbores as low risk, i.e., less than 1% likelihood to occur and having a consequence that is insubstantial, which the MRV plan states is less than 1% of injected volume during the duration of the event. The MRV plan further states that the risks were classified as low risk because the SSAU geology is well suited to CO_2 sequestration with an extensive confining zone that is free of fractures and faults that could be potential conduits for CO_2 migration. The MRV plan also states that the low risk is supported by the results of the reservoir model, which shows that stored CO_2 is not predicted to leave the SSAU boundary. Furthermore, SSAU states that the potential risk of wellbore CO_2 leakage will be mitigated through:

- Adhering to TRRC regulatory requirements for well drilling and testing,
- Implementing best practices that SSAU has developed through its extensive operating experience,
- Monitoring injection/production performance, wellbores, and the surface; and
- Maintaining surface and subsurface equipment.

Thus, the MRV plan provides an acceptable characterization of CO_2 leakage that could be expected through existing wellbores.

3.2 Leakage through Faults or Fractures

According to the MRV plan, there are no known faults or fractures that transect the San Andres reservoir in the project area. Therefore, SSAU claims that there is no risk of leakage due to fractures or faults. Nevertheless, SSAU will manage injection patterns so that injection pressures will not exceed the formation parting pressure (FPP). In addition, the IWR will be maintained to remain near 1.0. Both measures mitigate the potential for inducing faults or fractures.

Thus, the MRV plan provides an acceptable characterization of CO_2 leakage that could be expected through faults or fractures.

3.3 Leakage through Natural or Induced Seismicity

According to the MRV plan, there is no direct evidence that natural seismic activity poses a significant risk for loss of CO_2 to the surface in the Permian Basin, and more specifically in the SSAU. SSAU reviewed the nature and location of seismic events in West Texas using the United States Geologic Survey (USGS) database on recorded earthquakes. Their review showed that no magnitude (M) 3.0 or greater earthquakes have occurred within the SSAU. The closest earthquake occurred approximately 30 miles away in 1992. The MRV plan states that the absence of any M3.0 or greater seismic events at or near SSAU indicates that their injection operations at SSAU do not induce seismicity. Therefore, SSAU concludes that there is no likely seismicity pathway for CO_2 surface leakage. Finally, the MRV plan states that SSAU also participates in the TexNet seismic monitoring network and will continue to monitor for seismic signals that could indicate the creation of potential leakage pathways in SSAU.

Thus, the MRV plan provides an acceptable characterization of CO_2 leakage that could be expected from natural or induced seismicity.

3.4 Leakage From Previous Operations

The MRV plan states that to obtain permits for CO_2 flooding, the Area of Review (AoR) around all SSAU CO_2 injector wells was evaluated to determine if there were any unknown penetrations and to assess if any corrective action was required at any wells. SSAU found that no additional corrective action was needed to reduce the risk of leakage through previous well penetrations. Furthermore, SSAU claims that its standard practice for drilling new wells at SSAU includes a rigorous review of nearby wells to ensure that drilling will not cause damage to or interfere with existing wells. According to the MRV plan, these practices ensure that there are no unknown penetrations within the SSAU and that the risk of a release from legacy wells has been evaluated. SSAU also states that the successful experience with CO_2 flooding in SSAU demonstrates that the confining zone has not been impaired by previous operations.

Thus, the MRV plan provides an acceptable characterization of CO_2 leakage that could be expected from previous operations.

3.5 Leakage From Pipelines and Surface Equipment

The MRV plan states that SSAU considered potential risk of surface leakage associated with the production satellite, the central tank battery, and facility pipelines. SSAU states that the risks associated with pipelines and surface equipment were classified as low risk because the SSAU is operated in a manner that maintains, monitors, and documents the integrity of the reservoir. The MRV plan states that pipeline and surface equipment leakage is mitigated through adhering to regulatory requirements for well drilling and testing; implementing best practices that SSAU has developed through its extensive operating experience; monitoring injection/production performances, wellbores, and the surface; and maintaining subsurface and surface equipment. The MRV plan states that the facilities and pipelines currently utilize and will continue to utilize materials of construction and control processes that are standard for CO_2-EOR projects in the oil and gas industry. The MRV plan also states that operating and maintenance practices at SSAU currently follow and will continue to follow demonstrated industry standards.

Thus, the MRV plan provides an acceptable characterization of CO_2 leakage that could be expected from pipeline and surface equipment.

3.6 Leakage From Lateral Migration Outside the SSAU

The MRV plan states that it is highly unlikely that injected CO_2 will migrate downdip and laterally outside the SSAU because of the nature of the geology and the approach used for injection. The MRV plan explains that injected CO_2 will rise vertically towards the structurally highest point of the Upper San Andres formation, as well as overlying and underlying formations within the SSAU. The SSAU structure forms a trap configuration that funnels the injected CO_2 towards the crest of the structure, thereby preventing lateral migration beyond the SSAU boundary. Furthermore, the MRV plan asserts that the planned injection volumes and active fluid management during injection operations will prevent CO_2 from migrating laterally out of the structure. Finally, the MRV plan states that the total volume of stored CO_2 will be considerably less than the calculated capacity of the structure.

Thus, the MRV plan provides an acceptable characterization of CO_2 leakage that could be expected from lateral migration outside the SSAU.

3.7 Leakage From Drilling in the SSAU

The MRV plan states that, in accordance with TRRC rules, well casings shall be securely anchored in the hole in order to effectively control the well at all times, all useable quality water zones shall be isolated and sealed off to effectively prevent contamination or harm, and all productive zones, potential flows zones, and zones with corrosive formation fluids shall be isolated and sealed off to prevent vertical migration of fluids, including gases, behind the casing. The MRV plan asserts that all well drilling activity at the SSAU is conducted in accordance with TRRC rules. Finally, SSAU intends to operate SSAU for several more years and will continue to be vigilant about protecting the integrity of its assets and maximizing the potential of its resources, including oil, gas, and CO_2. SSAU also asserts that the risks associated with third parties penetrating the SSAU are negligible.

Thus, the MRV plan provides an acceptable characterization of CO_2 leakage that could be expected from drilling in the SSAU.

3.8 Leakage Through the Seal

The MRV plan states that diffuse leakage through the seal formed by the upper San Andres Formation is highly unlikely. SSAU believes that the presence of a gas cap trapped over millions of years confirms that the seal has been secure. The MRV plan states that injection pattern monitoring ensures that no breach of the seal will be created. Finally, SSAU believes that wellbores that penetrate the seal make use of cement and streel construction that is closely regulated to ensure that no leakage takes place.

Thus, the MRV plan provides an acceptable characterization of CO_2 leakage that could be expected through the seal.

The MRV plan concludes that, based on a careful assessment of the potential risk of release of CO_2 from the subsurface, it has been determined that there are no leakage pathways at the SSAU that are likely to result in significant loss of CO_2 to the atmosphere. Thus, the MRV plan provides an acceptable characterization of potential CO_2 leakage pathways as required by 40 CFR 98.448(a)(2).

4 Strategy for Detecting and Quantifying Surface Leakage of CO_2 and for Establishing Expected Baselines for Monitoring

40 CFR 98.448(a)(3) requires that an MRV plan contain a strategy for detecting and quantifying any surface leakage of CO_2, and 40 CFR 98.448(a)(4) requires that an MRV plan include a strategy for establishing the expected baselines for monitoring CO_2 surface leakage. Sections 5 and 6 of the MRV plan detail SSAU's strategy for monitoring and quantifying CO_2 leakage, and section 7 of the MRV plan details strategies for establishing expected baselines for CO_2 leakage. SSAU's approach for detecting and quantifying surface leakage of CO_2 primarily includes routine field inspections, SCADA system monitoring of wellhead pressures, Mechanical Integrity Testing (MIT), and monitoring reservoir pressure in WAG skids.

A summary table of SSAU's strategies for monitoring and responding to any possible CO_2 leakage can be found Table 3 of the MRV plan and is reproduced below:

Risk	Monitoring Plan	Response Plan
Tubing Leak	Monitor changes in tubing and annulus pressure; Mechanical Integrity Testing (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 bottomhole pressure control	Blowout during well operations	Expeditiously conduct well kill procedures
Unplanned wells drilled through San Andres	Routine field inspection to prevent unapproved drilling; compliance with TRRC permitting for planned wells	Ensure compliance with TRRC regulations
Loss of seal in abandoned wells	Reservoir pressure in WAG Skids; 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 Skids; high pressure found in new wells	Fluid management along lease lines
Leakage through induced fractures	Reservoir pressure in WAG Skids; high pressure found in new wells	Comply with rules for keeping injection pressures below parting pressure
Leakage due to seismic event	Reservoir pressure in WAG Skids; high pressure found in new wells	Shut in injectors near seismic event, assess reservoir and take corrective action as needed

4.1 Detection of Leakage from Existing Wellbores

Section 6.2.2 of the MRV plan states that SSAU 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 H_2S monitors.

The MRV plan states that anomalies in injection zone pressure may not necessarily indicate CO_2 surface leakage. However, SSAU states that if an investigation leads to a work order, field personnel would inspect the equipment in question and determine the nature of the problem. Where possible, repairs will be made with materials on hand and the mass of CO_2 surface leakage would be included in the 40 CFR Part §98 Subpart W report for the SSAU. If repairs require additional time and materials, the appropriate approach for quantifying the mass of CO_2 surface leakage using the relevant parameters (e.g., the rate, concentration, and duration) would be determined.

Section 6.2.2 of the MRV plan states anomalies in annular pressure or other issues detected during routine maintenance inspections would be treated in the same way as anomalies in injection zone pressure. Field personnel would inspect the equipment in question and determine the nature of the problem. Where possible, repairs will be made with materials on hand at the time of inspection and the mass of CO_2 surface leakage would be included in the 40 CFR Part §98 Subpart W report for SSAU. If repairs require additional time and materials, the affected well would be shut in, a work order would be generated, and the appropriate approach for quantifying the mass of CO_2 surface leakage using the relevant parameters (e.g., the rate, concentration, and duration) would be determined. The work order would serve as the basis for tracking the event for GHG reporting.

As described in Section 6.2.2 of the MRV plan, CO_2 release at the surface is very cold and leads to the formation of bright white clouds and ice that are easily spotted. Therefore, SSAU plans to employ visual inspections to detect unexpected releases from wellbores and surface facilities. 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. SSAU field personnel also check that injectors are on the proper WAG schedule and observe the facility for visible CO_2 emissions.

Finally, section 6.2.2 of the MRV plan states that H_2S monitors will also be used to help detect CO_2 leakage from wellbores. All SSAU field personnel wear H_2S monitors at all times. The H_2S monitor detection limit is 10 ppm; if an H_2S 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. H_2S is considered a proxy for potential CO_2 leaks in the field. Thus, detected H_2S leaks will be investigated to determine if CO_2 leaking is occurring.

Table 3 of the MRV plan provides a detailed characterization of detecting CO_2 leakage that could be expected through existing wellbores. Thus, the MRV plan provides adequate characterization of SSAU's approach to detect potential leakage from existing wellbores as required by 40 CFR 98.448(a)(3).

4.2 Detection of Leakage through Faults or Fractures

As stated in the MRV plan, there is no risk of leakage due to fractures or faults. Still, SSAU routinely updates measurements to determine FPP and reservoir pressure of the SSAU. The MRV plan states that an IWR at or near 1.0 is also maintained. Both measures mitigate the potential for inducing faults or fractures. As a safeguard, WAG skids are continuously monitored and equipped with automatic shutoff controls should injection pressures exceed programmed settings.

Table 3 of the MRV plan provides a detailed characterization of detecting CO_2 leakage that could be expected through faults or fractures. Thus, the MRV plan provides adequate characterization of SSAU's approach to detect potential leakage through faults or fractures as required by 40 CFR 98.448(a)(3).

4.3 Detection of Leakage through Natural or Induced Seismicity

The MRV plan states that SSAU concluded that there is no direct evidence that natural seismic activity poses a significant risk for loss of CO_2 to the surface in the Permian Basin, specifically in the SSAU. In addition, the MRV plan states that SSAU is not aware of any reported loss of injectant (brine water or CO_2) to the surface above SSAU associated with any seismic activity. If induced seismicity resulted in a pathway for material amounts of CO_2 to migrate from the injection zone, SSAU's other reservoir fluid monitoring provisions (e.g., reservoir pressure, well pressure, and pattern monitoring) would detect the migration and lead to further investigation.

Table 3 of the MRV plan provides a detailed characterization of detecting CO_2 leakage that could be expected through natural or induced seismicity. Thus, the MRV plan provides adequate characterization of SSAU's approach to detect potential leakage through natural or induced seismicity as required by 40 CFR 98.448(a)(3).

4.4 Detection of Leakage from Previous Operations

As stated in the MRV plan, SSAU reviewed the identified penetrations and determined that no additional corrective action was needed to prevent CO_2 leakage. SSAU's continuous monitoring program further mitigates the risk of a CO_2 surface leakage from the identified penetrations. The MRV plan states that reservoir pressure in WAG skids and high pressure found in new wells will help detect leakage from previous operations.

Table 3 of the MRV plan provides a detailed characterization of detecting CO_2 leakage that could be expected from previous operations. Thus, the MRV plan provides adequate characterization of SSAU's approach to detect potential leakage from previous operations as required by 40 CFR 98.448(a)(3).

4.5 Detection of Leakage from Pipelines and Surface Equipment

As stated in the MRV plan, the risk of surface leakage through pipelines and surface equipment were classified as low since SSAU is operated in a manner that maintains, monitors, and documents the integrity of the reservoir. Even still, the MRV plan states that SSAU personnel continuously monitor the pipeline using the Supervisory Control and Data Acquisition (SCADA) system and can detect and mitigate pipeline leaks expeditiously. Furthermore, the MRV plan states that 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 surface leakage be detected from pipeline or surface equipment, the mass of CO_2 surface leakage will be quantified by SSAU following the requirements of Subpart W of EPA's GHGRP.

Table 3 of the MRV plan provides a detailed characterization of detecting CO_2 leakage that could be expected from pipelines and surface equipment. Thus, the MRV plan provides adequate characterization of SSAU's approach to detect potential leakage from pipelines and surface equipment as required by 40 CFR 98.448(a)(3).

4.6 Detection of Leakage from Lateral Migration Outside the SSAU

The MRV plan explains that the nature of the geology and the approach used for injection at SSAU make it highly unlikely that injected CO_2 will migrate laterally outside the SSAU. Reservoir pressure in WAG headers and high pressure found in new wells will be indicative of leakage due to lateral migration outside of the SSAU.

Table 3 of the MRV plan provides a detailed characterization of detecting CO_2 leakage that could be expected from lateral migration outside the SSAU. Thus, the MRV plan provides adequate characterization of SSAU's approach to detect potential leakage from lateral migration as required by 40 CFR 98.448(a)(3).

4.7 Detection of Leakage from Drilling in the SSAU

As stated in the MRV plan, all well drilling activity at SSAU is conducted in accordance with TRRC rules. SSAU's visual inspection process, including routine site visits, will identify any unapproved drilling activity in the SSAU.

Table 3 of the MRV plan provides a detailed characterization of detecting CO_2 leakage that could be expected from drilling in the SSAU. Thus, the MRV plan provides adequate characterization of SSAU's approach to detect potential leakage from drilling as required by 40 CFR 98.448(a)(3).

4.8 Detection of Leakage through the Seal

As stated in the MRV plan, 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. SSAU claims that their injection monitoring program assures that no breach of the seal will be created. SSAU injection pressure is continuously monitored and unexplained changes in injection pressure that might indicate leakage would trigger investigation as to the cause.

Table 3 of the MRV plan provides a detailed characterization of detecting CO_2 leakage that could be expected through the seal. Thus, the MRV plan provides adequate characterization of SSAU's approach to detect potential leakage through the seal as required by 40 CFR 98.448(a)(3).

4.9 Quantification of Potential CO_2 Leakage

As described in Section 5.9 of the MRV plan, given the uncertainty concerning the nature and characteristics of any leaks that may be encountered, SSAU will determine the most appropriate method to quantify the volume of CO_2 using an event-driven process to assess, address, track, and (if applicable) quantify any potential CO_2 surface leakage. In the event surface CO_2 leakage is confirmed, 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. The MRV plan explains that potential quantification methods for any volume of CO_2 leakage detected may include but are not limited to:

- For leakage through wellbores, continuous SCADA monitoring data provide the basis to determine duration and the amount of CO_2 loss;
- For leakage from surface equipment and pipelines, continuous SCADA monitoring data and acceptable emission factors, such as those in 40 CFR Part §98 Subpart W, provide the basis to determine duration and the amount of CO_2 loss;
- For leakage related to the competency of the confining layer, reservoir modeling and engineering estimates provide the basis for determining the amount of CO_2 loss.

4.10 Determination of Baselines

According to the MRV plan, existing automatic systems will be utilized to identify and investigate excursions from expected performance that could indicate CO_2 emissions from the SSAU. SSAU primarily used data systems for operational control and monitoring and are set to capture more information than is necessary for reporting in the Annual Subpart RR Report. The MRV plan states that the necessary system guidelines to capture the information that is relevant to identify possible CO_2 surface leakage will be developed.

Visual Inspections

The MRV plan states that work orders are generated in the computerized management system (CMMS) for maintenance activities that cannot be addressed on the spot. SSAU states that they will develop methods to capture work orders that involve activities that could potentially involve CO_2 surface leakage. Each incident will be flagged for review by the person responsible for MRV documentation. Finally, SSAU states that the Annual Subpart RR Report will include an estimate of the mass of CO_2 surface leakage. Records of information used to calculate emissions will be maintained on file for a minimum of three years.

Personal H_2S Monitors

The MRV plan states that SSAU's injection gas compositional analysis indicates that the total injected fluid stream is approximately 1% H_2S. SSAU states that H_2S monitors will always be worn by all field personnel. Therefore, SSAU considers H_2S to be a proxy for potential CO_2 leaks in the field. The H_2S

monitors detect concentrations of H_2S up to 500 ppm in 0.1 ppm increments and will sound an alarm if the detection limit exceeds 10 ppm. If an H_2S 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. The Subpart RR Annual Report will provide an estimate of the amount of CO_2 emitted from any such incidents.

Injection Rates, Pressures and Volumes

The MRV plan states that target injection rate and pressure for each injector are developed within the permitted limits based on the results of ongoing reservoir modeling. The MRV plan states that the injection targets are programmed into the WAG satellite controllers. High and low set points are also programmed into the controllers, and flags are generated whenever statistically significant deviations from these ranges are identified. The MRV plan states that for purposes of Subpart RR reporting, flags (or excursions) will be screened to determine if they could lead to CO_2 surface leakage. The Annual Subpart RR Report will provide an estimate of the mass of CO_2 confirmed surface leakage.

Production Volumes and Compositions

The MRV plan states that a general forecast of production volumes and composition is developed and used to evaluate performance periodically and refine current and projected injection plans and the forecast. The MRV plan implementation lead will review any generated work order from the CMMS and identify those that could result in CO_2 surface leakage. Should such events occur, the mass of CO_2 confirmed surface leakage would be calculated following the approaches described in Sections 5 and 6 of the MRV plan. Impact to Subpart RR reporting will be addressed, if deemed necessary.

Thus, SSAU provides an acceptable approach for detecting and quantifying leakage and for establishing expected baselines in accordance with 40 CFR 98.448(a)(3) and 40 CFR 98.448(a)(4).

5 Considerations Used to Calculate Site-Specific Variables for the Mass Balance Equation

5.1 Calculation of Mass of CO_2 Received

According to Section 8 of the MRV plan, SSAU will use Equation RR-2 to calculate the mass of CO_2 Received. CO_2 will be measured at the custody transfer meter (M2) from the Permian Basin CO_2 pipeline delivery system. Because there is no redelivery of CO_2, Sr,p will be zero (“0”). Quarterly CO_2

$$CO_2T,r = \sum_{p=1}^{4} (Q_{p,r} - S_{r,p}) * D * C_{CO2,r,p} \qquad \text{(Eq. RR-2)}$$

concentrations will be taken from the gas measurement database. The volumetric flow at standard conditions will be multiplied by the CO_2 concentration and the density of CO_2 at standard conditions to determine the net Annual Mass of CO_2 Received.

Where:

$CO_{2T,r}$ = Net annual mass of CO_2 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 CO_2 at standard conditions (metric tons per standard cubic meter), 0.0018682;

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

p = Quarter of the year; and

r = Receiving flow meters.

The MRV also states that Equation RR-3 will be used to sum the mass of CO_2 received from all receiving flow meters.

$$CO_2 = \sum_{r=1}^{R} CO_{2T,r} \qquad \text{(Eq. RR-3)}$$

Where:

CO_2 = Total net annual mass of CO_2 received (metric tons).

$CO_{2T,r}$ = Net annual mass of CO_2 received through flow meter r (metric tons).

SSAU provides an acceptable approach to calculating the mass of CO_2 received.

5.2 Calculation of Mass of CO_2 Injected

The MRV plan states that the amount of CO_2 injected is measured at flow meters M2 and M3. Equation RR-5 will be used to calculate the mass of CO_2 flowing through each of these meters. Quarterly CO_2 concentration will be taken from the gas measurement database. The volumetric flow at standard conditions will be multiplied by the CO_2 concentration and the density of CO_2 at standard conditions to determine net Annual Mass of CO_2 Injected.

$$CO_{2u} = \sum_{p=1}^{4} Q_{p,u} * D * C_{CO2,p,u} \qquad \text{(Eq. RR-5)}$$

Where:

CO_{2u} = Annual CO_2 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 CO_2 at standard conditions (metric tons per standard cubic meter), 0.0018682;

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

p = Quarter of the year; and

u = Flow meter.

The MRV plan also states that Equation RR-6 will be used to calculate the total Mass of CO_2 Injected, which is the sum of the Mass of CO_2 from flow meters M2 and M3.

$$CO_{2I} = \sum_{u=1}^{U} CO_{2,u} \qquad \text{(Eq. RR-6)}$$

Where:

CO_{2u} = Annual CO_2 mass recycled (metric tons) as measured by flow meter u + Net annual mass of CO_2 received through flow meter r (metric tons).

SSAU provides an acceptable approach to calculating the mass of CO_2 injected in accordance Subpart RR requirements.

5.3 Mass of CO_2 Produced

The MRV plan states that Equation RR-8 will be used to calculate the Mass of CO_2 Produced at flow meter M4. Quarterly CO_2 concentration will be taken from the gas measurement database. The volumetric flow at standard conditions will be multiplied by the CO_2 concentration and the density of CO_2 at standard conditions to determine net Annual Mass of CO_2 Received.

$$CO_{2w} = \sum_{p=1}^{4} Q_{p,w} * D * C_{CO2,p,w} \qquad \text{(Eq. RR-8)}$$

Where:

CO_{2W} = Annual CO_2 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 CO_2 at standard conditions (metric tons per standard cubic meter), 0.0018682;

$CCO_{2,pw}$ = CO_2 concentration measurement in flow for meter w in quarter p (vol. percent CO_2, expressed as a decimal fraction);

p = Quarter of the year; and

w = Separator.

The MRV plan also states that Equation RR-9 will be used to calculate the amount of CO_2 entrained in oil at the custody transfer meters for oil sales (M4).

$$CO_{2,p} = (1+X) * \sum_{w=1}^{W} CO_{2,w} \quad \text{(Eq. RR-9)}$$

Where:

CO_{2P} = Total annual CO_2 mass produced (metric tons) through all meters in the reporting year.

CO_{2w} = Annual CO_2 mass produced (metric tons) through meter w in the reporting year;

X = Entrained CO_2 in produced oil or other fluid divided by the CO_2 separated through all separators in the reporting year (weight percent CO_2, expressed as a decimal fraction).

w = Separator.

SSAU provides an acceptable approach for calculating the mass of CO_2 produced under the Subpart RR requirements.

5.4 Calculation of Mass of CO_2 Emitted by Surface Leakage

The MRV plan states that the total annual Mass of CO_2 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. SSAU is prepared to address the potential for leakage in a variety of settings. Estimates of the mass of confirmed CO_2 surface leakage will depend on several site-specific factors including measurements, engineering estimates, and emission factors, depending on the source and nature of the CO_2 surface leakage.

The MRV plan also states that the process for quantifying the mass of CO_2 surface leakage will entail using best engineering principles or emission factors. In the event CO_2 surface leakage is confirmed the mass of CO_2 surface leakage would be quantified and reported, and records that describe the methods used to estimate or measure the mass emitted 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 the mass of CO_2 surface leakage are not double-counted.

Equation RR-10 in §98.433 will be used to calculate and report the Mass of CO_2 emitted by surface leakage:

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

Where:

CO_{2E} = Total annual CO_2 mass emitted by surface leakage (metric tons) in the reporting year.

CO_{2x} = Annual CO_2 mass emitted (metric tons) at leakage pathway x in the reporting year.

x = Leakage pathway.

SSAU provides an acceptable approach for calculating the mass of CO_2 emitted by surface leakage under the Subpart RR requirements.

5.5 Calculation of Mass of CO_2 Sequestered

The MRV plan states that Equation RR-11 will be used to calculate the Mass of CO_2 Sequestered in Subsurface Geologic Formations in the Reporting Year as follows:

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

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.

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.

SSAU provides an acceptable approach for calculating the mass of CO_2 sequestered under Subpart RR requirements.

6 Summary of Findings

The Subpart RR MRV plan for OXY USA, INC.'s Seminole San Andres Unit facility meets the requirements of 40 CFR 98.238. The regulatory provisions of 40 CFR 98.238(a), which specifies the requirements for MRV plans, are summarized below along with a summary of relevant provisions in the SSAU MRV plan.

Subpart RR MRV Plan Requirement	SSAU MRV Plan
40 CFR 98.448(a)(1): Delineation of the maximum monitoring area (MMA) and the active monitoring areas (AMA).	Section 4 of the MRV plan defines and delineates the MMA and AMA. SSAU constructed a history matched reservoir model using tNavigator to delineate their AMA and MMA. Both the AMA and MMA are defined by the boundary of SSAU boundary plus the required ½ mile buffer.
40 CFR 98.448(a)(2): Identification of potential surface leakage pathways for CO_2 in the MMA and the likelihood, magnitude, and timing, of surface leakage of CO_2 through these pathways.	Section 5 of the MRV plan identifies and evaluates potential surface leakage pathways. The MRV plan identifies the following potential pathways: existing well bores; faults and fractures; natural and induced seismic activity; previous operations; pipeline/surface equipment; lateral migration outside the SSAU; drilling through the CO_2 area; and diffuse leakage through the seal. The MRV plan analyzes the likelihood, magnitude, and timing of surface leakage through these pathways. SSAU determined there are no leakage pathways at the SSAU that are likely to result in CO_2 surface leakage.
40 CFR 98.448(a)(3): A strategy for detecting and quantifying any surface leakage of CO_2.	Sections 5 and 6 of the MRV plan describe the strategies that SSAU intends to use to detect and quantify potential CO_2 leakage to the surface should it

	occur. Strategies include modeling, engineering estimates, and direct measurements.
40 CFR 98.448(a)(4): A strategy for establishing the expected baselines for monitoring CO_2 surface leakage.	Section 7 of the MRV plan describes SSAU's strategy for establishing expected baselines against which monitoring results will be compared to assess potential surface leakage. Strategies include visual inspections; personal H_2S monitors; the monitoring of injection rates, pressures, and volumes; and the monitoring of production volumes and compositions.
40 CFR 98.448(a)(5): A summary of the considerations you intend to use to calculate site-specific variables for the mass balance equation.	Section 8 of the MRV plan describes SSAU's approach to determining the amount of CO_2 sequestered using the Subpart RR mass balance equations, including calculation of total annual mass emitted from equipment leakage.
40 CFR 98.448(a)(6): For each injection well, report the well identification number used for the UIC permit (or the permit application) and the UIC permit class.	Section 12 (Appendix) of the MRV plan provides well identification numbers for all active wells in the SSAU as of September 2020. The MRV plan specifies that all the injection wells in the SSAU are permitted by the TRRC as UIC Class II wells.
40 CFR 98.448(a)(7): Proposed date to begin collecting data for calculating total amount sequestered according to equation RR-11 or RR-12 of this subpart.	Section 9 of the MRV plan states that the proposed date on which SSAU intends to begin collecting data for calculating total amount of CO_2 sequestered according to equation RR-11 is January 1, 2023.

Appendix A: Final MRV Plan

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

July 2023

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1. Introduction

OXY USA INC, a subsidiary of Occidental (Oxy) operates a CO_2-Enhanced Oil Recovery (CO_2-EOR) project in the Seminole San Andres Unit (SSAU). This Monitoring, Reporting, and Verification (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 CO_2 sequestered at the SSAU during a specified period of injection.

2. Facility Information

2.1 Reporter Number

XXXX –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 in-service wells in the SSAU (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 SSAU are currently classified as UIC Class II wells.

2.3 Existing Wells

Wells in the SSAU are identified by name and number, API number, type, and status. The list of wells as of November 2022 is included in Section 12.1. Any changes in these wells or additional wells will be indicated in the annual monitoring report.

3. Project Description

This project takes place in the SSAU, an oilfield located in West Texas that was first produced in 1941. CO_2 flooding was initiated in 1983 and the injection plan calls for an additional total of approximately 174 million metric tons of CO_2 to be stored over the remaining lifetime of the project. The field is well characterized and Oxy determined that it 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 1.0 or very close to it. Oxy constructed a history-matched reservoir simulation of the injection at SSAU.

3.1 Project Characteristics

The Seminole San Andres field was discovered in 1936 and started producing in 1941. The field was unitized in 1968, and waterflood was initiated in 1969. CO_2 flooding was initiated in 1983. A long-term forecast for SSAU was developed using the reservoir modeling approaches described in Section 3.4, including storage of an additional total of approximately 174 million metric tons of CO_2 over the remaining life of the project. Figure 1 shown below, is a graph of the quantity of CO_2 injected, produced, and stored between 1983 and 2021 (solid lines) and a forecast of the CO_2 that will be injected, produced, and stored between 2022 and 2055 (dashed lines) in the SSAU. Oxy has injected 224 million metric tons (MMT) of CO_2 into the SSAU through the end of 2021. Of

that amount, 109 MMT CO_2 was produced and reinjected, and 115 MMT CO_2 was stored. Oxy forecasts CO_2 injection of 532 MMT from the year 2022 until the year 2055, which is currently projected to be the end of the project. Of that amount, 358 MMT is forecast to be produced and 174 MMT will be stored.

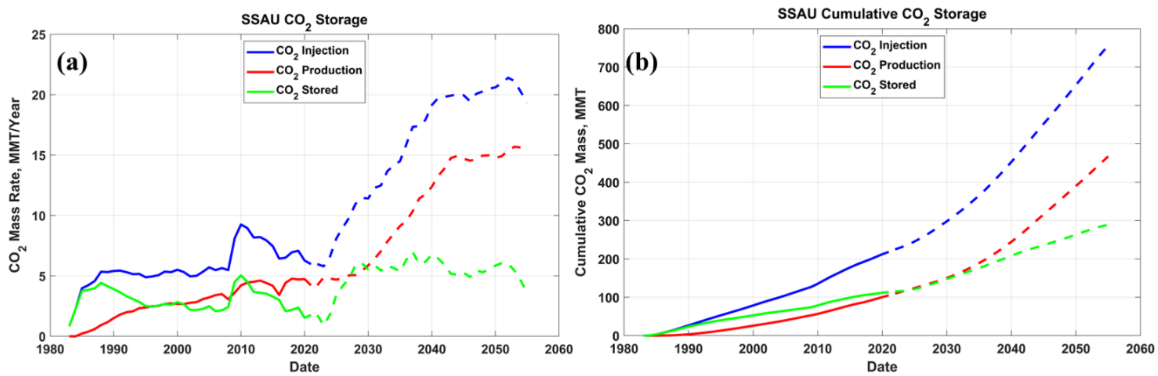

Figure 1—SSAU Historic and Forecast CO_2 Injection, Production, and Storage (a) Rate (MMT/Year), (b) Cumulative Mass (MMT)

3.2 Environmental Setting

The SSAU is located in the northeast portion of the Central Basin Platform in West Texas (Figure 2).

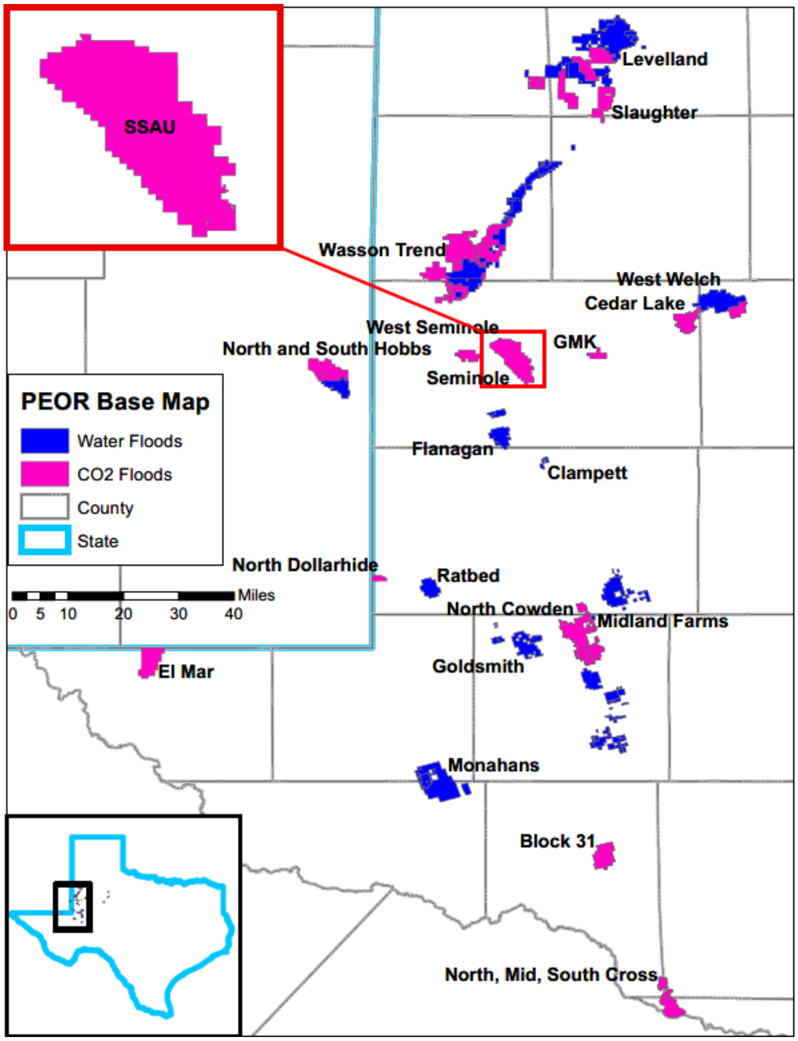

Figure 2—Location of SSAU in West Texas

Figure 3 is a schematic of the SSAU storage complex. The SSAU sequestration zone ranges between 1,165 and 1,850 ft in thickness with an average thickness of 1,600 ft. This productive interval, or reservoir, is within the San Andres Formation and 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.

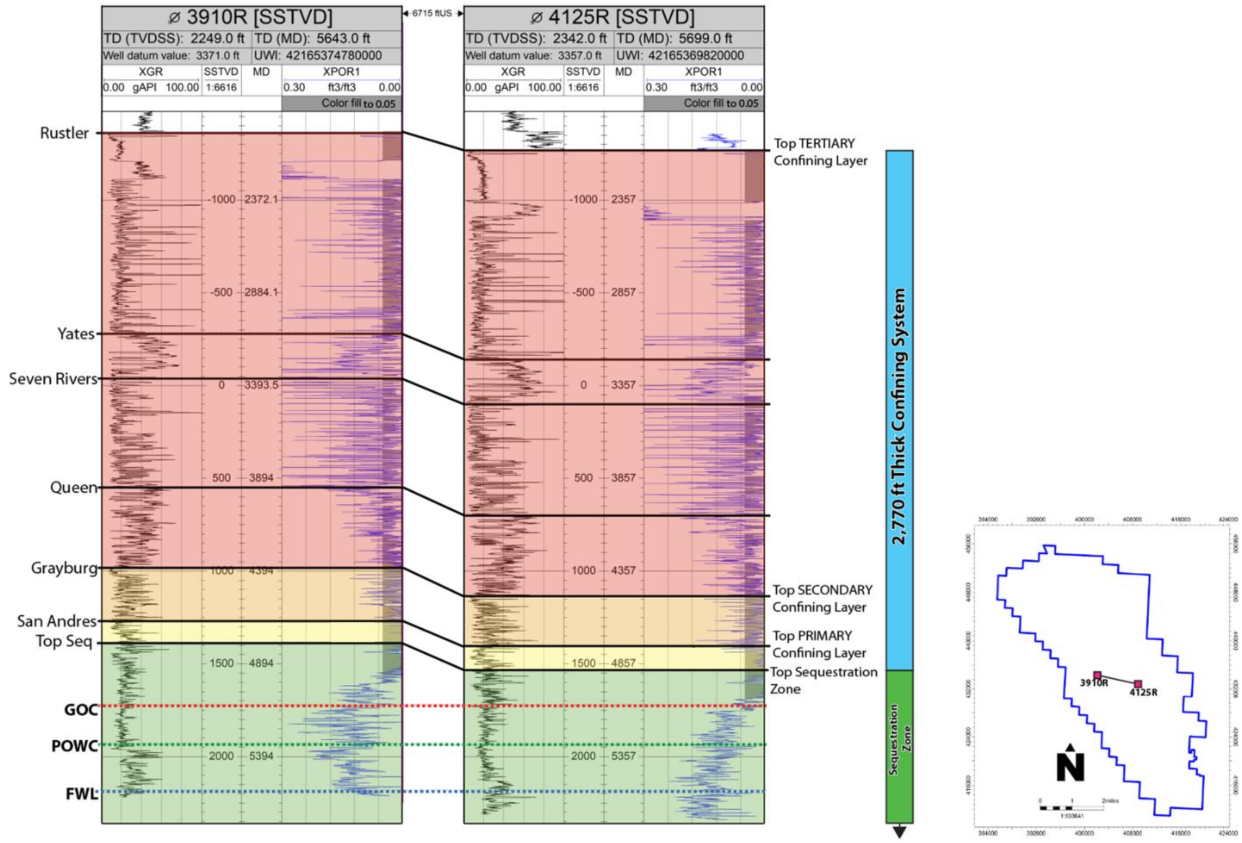

Figure 3—SSAU Geologic Column. Notes: TD = Total Depth, TVDSS or SSTVD = Total Vertical Depth Subsea, MD = Measured Depth, UWI = Unique Well Identification number, XGR = Gamma Ray log, XPOR1 = Porosity log, GOC = Gas Oil Contact, POWC = Producing Oil Water Contact, FWL = Free Water Level.

Figure 3 shows the overlying confining system, which consists of non-porous anhydritic strata that are ~2,770 ft thick and are comprised of three sub-zones:

- A ~95 ft thick primary confining layer between the top of sequestration zone and top of San Andres Formation;
- A ~200 ft thick secondary confining layer between San Andres Formation and Grayburg Formation; and,
- A ~2,350 ft thick tertiary confining layer from the Grayburg Formation to the Rustler Formation.

There are numerous relatively thin layers that provide additional secondary containment between the sequestration zone and freshwater aquifers found at a depth of 250 feet. These layers are comprised of siltstones, shales, salts, and anhydrite sequences with little to no porosity or permeability.

SSAU is located in the Permian Basin on the northeast portion of the Central Basin Platform in West Texas. SSAU is draped over a fault-bounded doubly plunging anticline that tips out in Devonian strata where several N-NW trending seismically resolvable faults have been identified and mapped. Faults are situated southwest of the structural crest, with a maximum offset of 1,800 ft within Devonian strata and tip out approximately 1,700 ft below the SSAU sequestration zone. Oxy extensively analyzed seismic data acquired over the SSAU to assess potential leakage pathways and basement-rooted faults. Oxy determined that seismic attributes, such as coherence, do not reveal linear discontinuities beyond those currently mapped. Likewise, Oxy found that downhole measurements from profile logs and micro-resistivity imaging tools show no indication of conductive faults or fractures. Pressure-based interference tests and simulation-based history matching also indicate that reservoir behavior has not been modified by faults and fractures. In summary, Oxy determined that multiple fault/fracture characterization tools indicate the sequestration zone and confining system are free of faults and fractures that could act as leakage pathways.

SSAU is a dome structure that includes the highest elevations within the area. The elevated area forms a natural trap for oil and gas that migrated upward from deeper source rocks over millions of years. Once trapped in these higher elevations, the oil and gas remained in place. In the case of SSAU, this oil and gas has been trapped in the reservoir for 50 to 100 million years. Over time, buoyant fluids, including CO_2, rose vertically until reaching the highest elevation of the structure. Figure 4 shows the Top San Andres pay interval structure. The colors in the structure map in Figure 4 indicate the subsurface elevation, with red illustrating a higher or shallower level and dark blue illustrating a lower or deeper level.

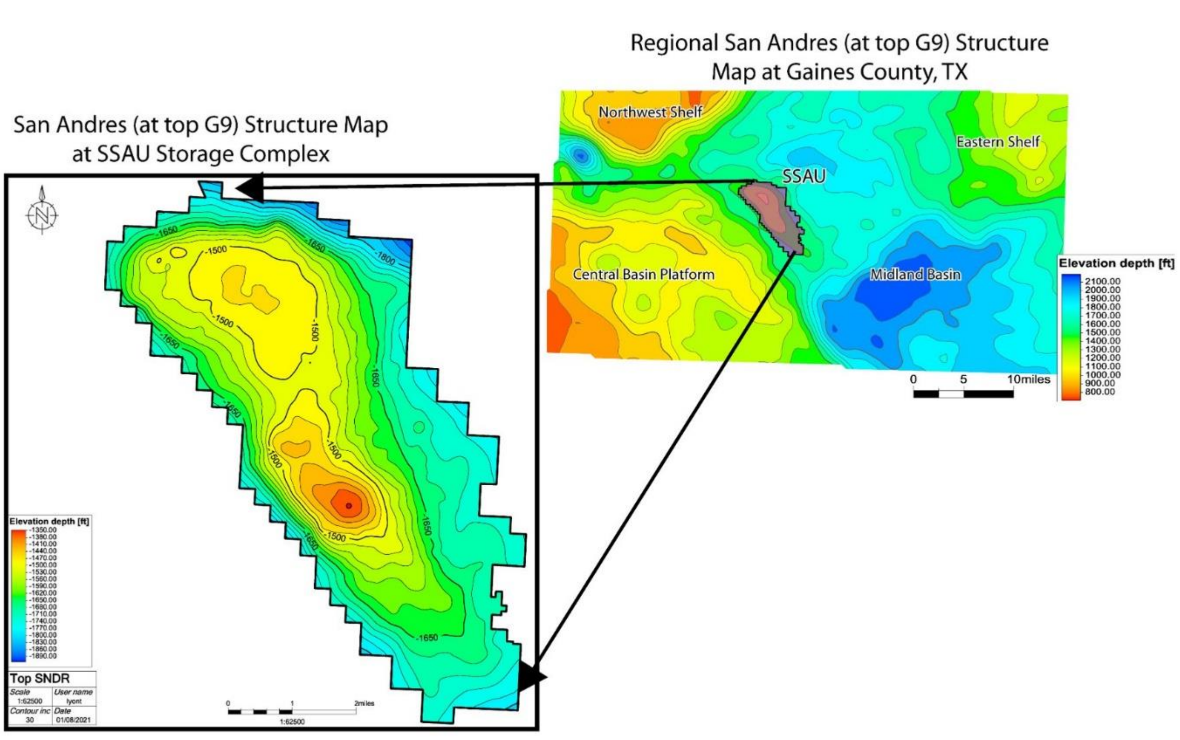

Figure 4—Local Area Structure on Top of San Andres. Note: Top SNDR = Top San Andres

Because of buoyancy differences between oil, water and gas phases, the gas column at SSAU sits above the oil. Water, being the least buoyant of the three fluid phases, is found below the oil. At the time of its discovery, natural gas was trapped at the structural high points of SSAU, 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 Formation. Gas is buoyant and highly mobile. If it could escape SSAU naturally, through faults or fractures, it would have done so over the millennia. Below the gas cap is an oil accumulation called the oil zone. There are no distillable hydrocarbons below the oil zone.

Once the CO_2 flood is complete and injection ceases, the remaining mobile CO_2 will rise slowly upward, driven by buoyancy forces and will be trapped by the confining system. There is more than enough pore space to sequester the planned CO_2 injection. The amount of CO_2 injected will not exceed the reservoir's secure storage capacity; consequently, there is negligible risk that CO_2 could migrate to other reservoirs in the Central Basin Platform. The total reservoir pore volume is calculated to be 5,816 million reservoir barrels (MMRB) from the top of the reservoir down to the base of the oil zone. This equals the volume of rock multiplied by porosity. Table 1 shows the conversion of this amount of pore space into an estimated maximum mass of CO_2 storage of approximately 509 MMT. The total stored CO_2 from previous EOR and the planned forecast injection will fill approximately 57% of the total calculated storage capacity.

Table 1—Calculation of Maximum CO_2 Storage Capacity (MMT) at SSAU

Top of Pay to Free Water Level (2,175 ft subsea)	
Variables	SSAU Outline
Pore Volume (MMRB)	5,816
B_{CO_2}	0.41
S_{wirr}	0.18
S_{orCO_2} (volume weighted)	0.14
Max CO_2 Billion Cubic Feet (Bcf)	9,646
Max CO_2 (MMT)	509

$$\text{Max } CO_2 = \text{Pore Volume (RB)} * (1 - S_{wirr} - S_{orCO2}) / B_{CO2}$$

Where:

Max CO_2 = maximum CO_2 storage capacity, MMT
Pore Volume (RB) = volume of the rock formation in Reservoir Barrels
B_{CO2} = formation volume factor for CO_2
S_{wirr} = irreducible water saturation
S_{orCO2} = irreducible oil saturation

Oxy has a high degree of confidence that stored CO_2 will be contained securely within the reservoir because: 1) SSAU is located at the highest subsurface elevations in the area; 2) the confining zone has proved competent over millions of years and with current CO_2 flooding; and, 3) SSAU has ample storage capacity.

3.3 Description of CO_2-EOR Project Facilities and the Injection Process

Figure 5 shows a simplified process flow diagram (PFD) of the project facilities and equipment in the SSAU. CO_2 is delivered to SSAU via the Permian Basin CO_2 pipeline network from several different sources.

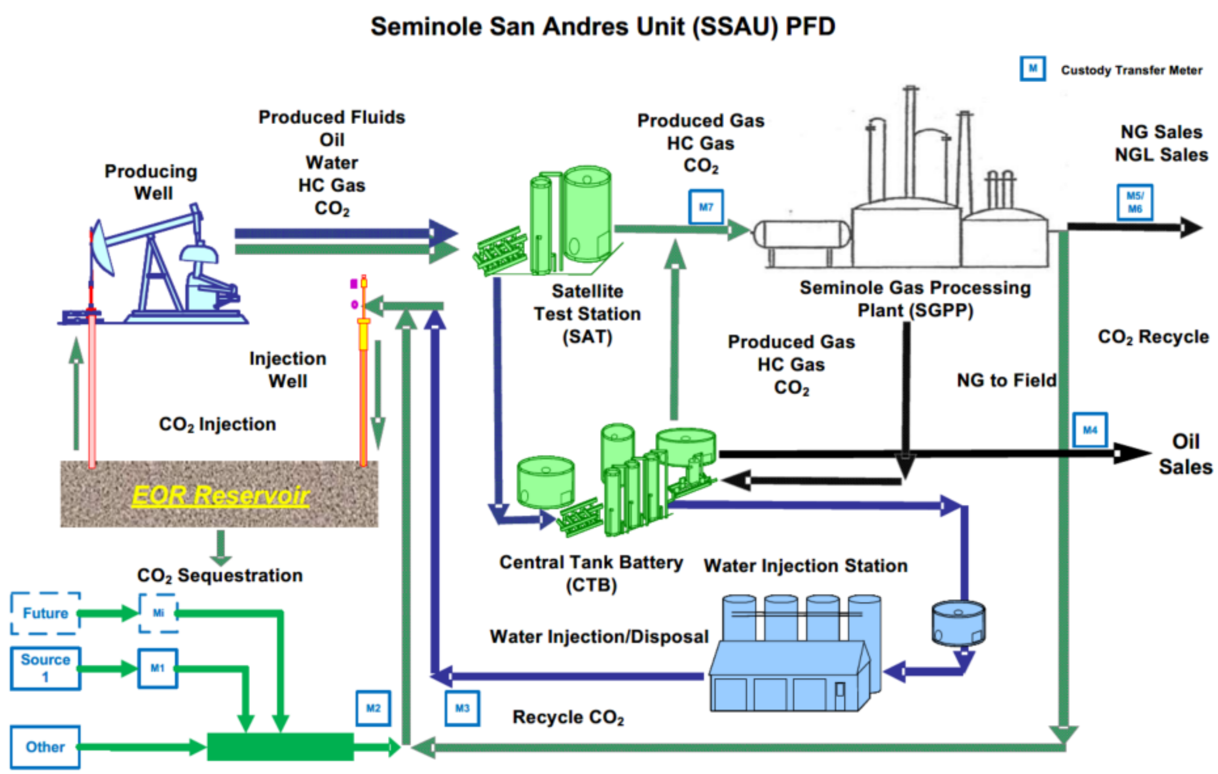

Figure 5—SSAU Process Flow Diagram. Notes: HC = Hydrocarbon, NG = Natural Gas, NGL = Natural Gas Liquids

Once CO_2 enters SSAU, there are three main processes involved in EOR operations:

1. **CO_2 Distribution and Injection.** The mass of CO_2 received at SSAU is metered and calculated through the custody transfer meter located at the pipeline delivery point, as indicated by the box labeled "M2" in the bottom left of Figure 5. The mass of CO_2 received is combined with recycled CO_2 from the Seminole Gas Processing Plant (SGPP), denoted by box labeled "M3," and distributed to the CO_2 trunklines for injection into the injection wells according to the pre-programmed injection plan for each well pattern, which alternates between water and CO_2 injection. This is an EOR project, and reservoir pressure must be maintained above the minimum miscibility pressure (MMP). Therefore, injection pressure is maintained at a level that is sufficiently high to allow injectants to enter the reservoir, but below the formation parting pressure (FPP).

2. **Produced Fluids Handling.** Produced fluids from the production wells are a mixture of oil, hydrocarbon gas, water, CO_2, and trace amounts of other constituents in the field including nitrogen and hydrogen. Fluids are gathered from producer wells and sent to

satellite test stations (SAT) for separation into a gas/CO_2 mix and a produced fluids mix of water, oil, gas, and CO_2. The gas/CO_2 mix, which is composed primarily of hydrocarbons and CO_2, is sent to the SGPP for CO_2 separation, dehydration, sweetening, and compression before reinjection into the reservoir. The mix of water, oil, gas, and CO_2 is sent to the central tank battery (CTB) where water is separated for reinjection or disposal; oil is separated for sale and metered through a custody transfer meter, and then moved into the pipeline; and, the remaining gas/CO_2 mix is combined with gas/CO_2 separated from the produced fluids in the SAT. The total amount of CO_2 produced is measured using meters labeled "M4" and "M3" on Figure 5.

3. **Water Treatment and Injection.** Water is recovered from the CTB for reuse and forwarded to the water injection station for treatment and reinjection using a closed loop process or for disposal.

3.3.1 Wells in the SSAU

The 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 Oil and Gas Procedure Manual (see Appendix 12.2). 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 underground sources of drinking water 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 where they are encountered into other strata, or into subsurface and surface waters;
- A completion report for each well that includes an electric log (e.g., a density, sonic, or resistivity) 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 and the location and setting of plugs; and,
- Injection well operators must identify an Area of Review (AoR), use materials and equipment compatible with the injection fluids, test, and maintain well records.

Table 2 provides a well count by type and status as of November 2022. All these wells are in material compliance with TRRC rules.

Table 2—SSAU Well Penetrations by Type and Status (as November 2022)

Row Labels	ACTIVE	INACTIVE	P&A	SHUT-IN	TA	Grand Total
INJ_H2O	27	4	16	0	10	57
INJ_WAG	190	3	11	4	2	210
PROD_OIL	306	21	60	0	30	417
Grand Total	**523**	**28**	**87**	**4**	**42**	**684**

Notes: INJ_H2O = water injector, INJ_WAG = Water Alternating Gas Injector, PROD_OIL = Oil producer, P&A = Plugged and Abandoned, TA = Temporarily Abandoned

As indicated in Figure 6, wells are distributed across the SSAU. The well patterns currently undergoing CO_2 flooding are outlined in the black box. During the life of the project the well count and status is projected to change as the SSAU injection plan is implemented. Oxy may seek TRRC approval to drill new wells, recomplete existing wells, or plug and abandon existing wells. Such changes will be included in the annual monitoring report.

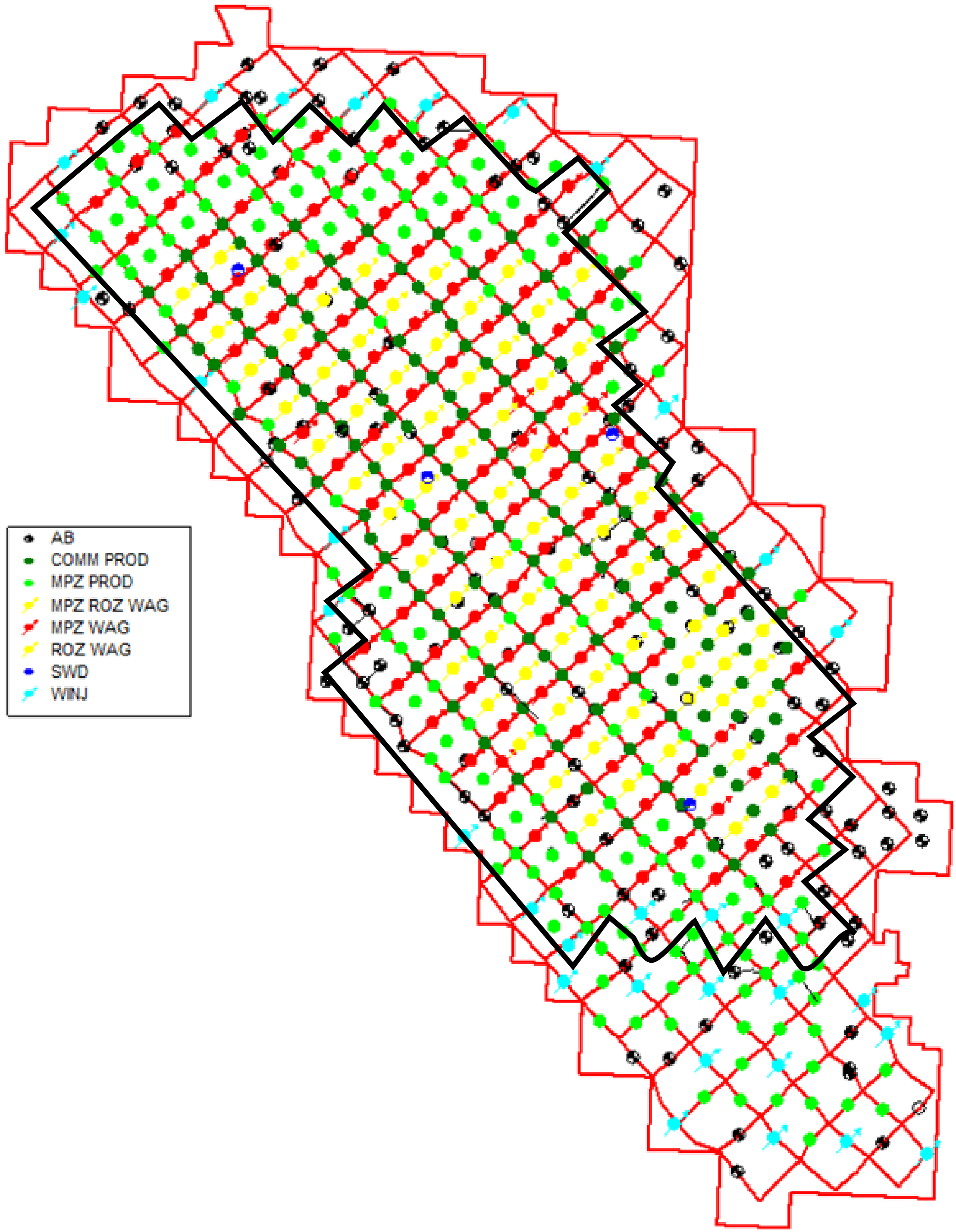

Figure 6—SSAU Wells and Injection Patterns. Notes: AB = Abandoned, COMM PROD = Commingled Producer, MPZ PROD = Main Pay Zone Producer, MPZ ROZ WAG = Main Pay Zone Residual Oil Zone Water Alternating Gas, MPZ WAG = Main Pay Zone Water Alternating Gas, ROZ WAG = Residual Oil Zone Water Alternating Gas, SWD = Saltwater Disposal, WINJ = Water Injector

SSAU CO_2 EOR operations are designed to avoid conditions that could damage the reservoir and create a potential leakage pathway. Oxy manages reservoir pressure by maintaining an injection-to-withdrawal ratio (IWR)[1] of approximately 1.0. To do this, 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 oilfield.

Oxy maintains injection pressure below the FPP, which is measured using step-rate tests.

3.4 Reservoir Modeling

A history-matched reservoir model of the current and forecast SSAU CO_2 injection plan has been constructed using tNavigator, which is a commercially available reservoir simulation software program. The model simulates the recovery mechanism in which CO_2 is miscible with the hydrocarbon phase in the reservoir.

The model was created to:

- Demonstrate that the storage complex has, at the minimum, the capacity to contain the planned mass of injected CO_2; and
- Track injected CO_2, identify how and where CO_2 is trapped in the SSAU, and monitor sequestration mass and distribution.

The reservoir model utilizes four types of data:

1. Site Characteristics as described in the SSAU geomodel,
2. Initial reservoir conditions and fluid property data,
3. Capillary pressure data, and
4. Well data.

The static geomodel that serves as the foundation for the dynamic simulation model used data from digital open- and cased-hole logs of 684 wells within the SSAU boundary to correlate formation tops. Oxy developed a sequence stratigraphic framework for SSAU based on core descriptions and outcrop analogs. Oxy selected the sequence stratigraphic correlations of flow units at the base of mud-dominated flooding surfaces in core, linked to well logs, and extrapolated throughout the field.

The dynamic simulation model is a four-component model consisting of water, oil, reservoir gas, and injected CO_2. It is an extension of the black oil model that enables the modeling of various recovery mechanisms, including miscible injection of CO_2, which is justified because the reservoir under study is above MMP. Oxy used the total hydrocarbon and solvent (CO_2) saturation to calculate relative permeability to water. Oxy then used the solvent and oil relative permeability to

[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.

calculate multipliers from a look-up table. Oxy used the Todd-Longstaff[2] model to calculate the effective viscosity and density of the hydrocarbon and solvent phases.

Oxy conducted history matching on the dynamic simulation model to adjust input parameters within the range of data uncertainties until the actual reservoir performance was closely reproduced in the model. Using this process, Oxy obtained an 84-year history match. 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 four graphs in Figure 7 present the history match results of oil rate, water rate, liquid rate, and gas rate, showing that the reservoir model provides an excellent match to actual historical data. Figure 8 shows the matches of water and CO_2 injection.

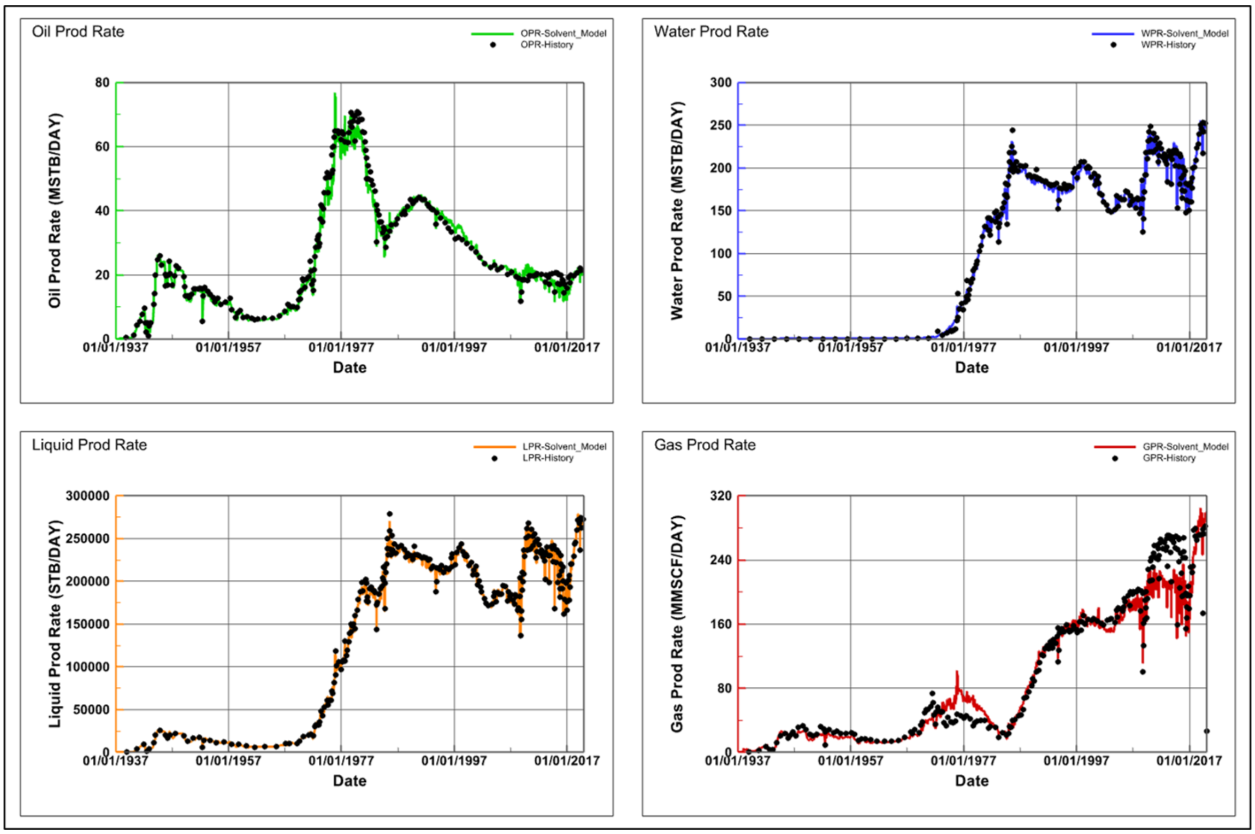

Figure 7—Four Parameters of History-Matched Modeling in the SSAU Reservoir Model. Notes: OPR = Oil Production Rate; WPR = Water Production Rate; MSTB/Day = Thousand Stock Tank Barrels per Day, MMSCF/Day = Million Standard Cubic Feet per Day

[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).

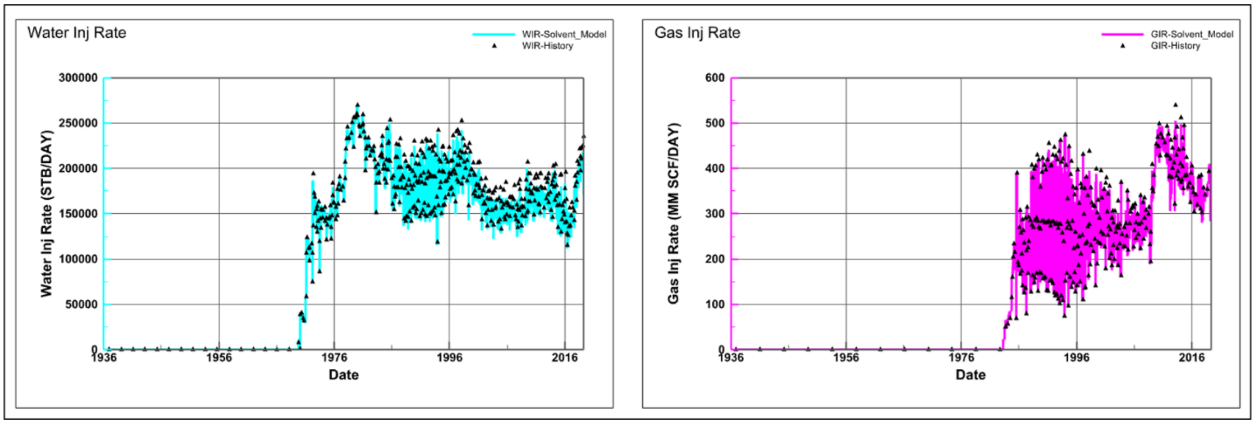

Figure 8—Plots of Injection History Match in the SSAU Reservoir Model. Note: WIR = Water Injection Rate; GIR = Gas Injection Rate

Oxy used the SSAU reservoir model to evaluate the plume of CO_2 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's CO_2 storage performance. The model forecast showed that CO_2 is contained in the reservoir within the boundaries of SSAU.

4. Delineation of Monitoring Area and Timeframes

4.1 Active Monitoring Area

The Active Monitoring Area (AMA) is shown in Figure 9. It is the SSAU plus the required ½-mile buffer. 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).

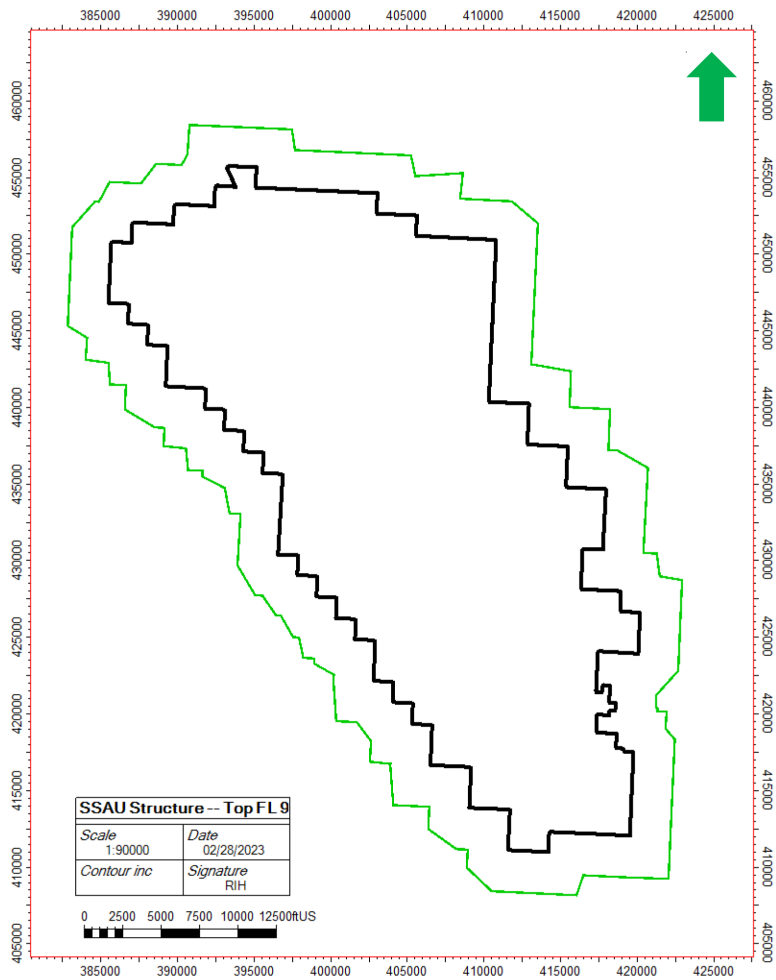

Figure 9—SSAU Unit Boundary with the ½ mile buffer boundary (green)

The AMA determination is supported by project design and site geology as follows:

- Oxy operates injector and producer wells throughout the SSAU as indicated in Figure 6.
- CO_2 injected into the SSAU remains contained within the SSAU because of Oxy's fluid and pressure management practices, i.e., the maintained IWR of 1.0 is consistent with stable reservoir pressure. Managed lease line injection and production wells are used to retain fluids, and operational results confirm that the injected CO_2 is retained within the SSAU.
- The SSAU is a structural high within the formation, therefore CO_2 will migrate updip within the SSAU to the structurally highest position and be retained by the geologic confining unit. CO_2 will not migrate downdip.

4.2 Maximum Monitoring Area

The Maximum Monitoring Area (MMA) is the SSAU plus the required ½-mile buffer (see Figure 9). The maximum extent of CO_2 after the CO_2 plume has stabilized will be contained within the SSAU, therefore the boundary of SSAU plus ½ mile buffer is consistent with the definition in 40 CFR 98.449. After operations cease, the CO_2 plume is projected to remain within the SSAU due to the factors described in Section 3.2 (presence of a structural trap, competent confining zone that has sealed for millions of years, and sufficient pore space), and use of IWR of approximately 1.0. The reservoir model shows that by the end of CO_2 injection, average reservoir pressure will be approximately 2,790 psi. Once injection ceases, reservoir pressure is predicted to stabilize within one year. Over time, reservoir pressure is expected to decline 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.

4.3 Monitoring Timeframes

The primary purpose for injecting CO_2 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 CO_2 in the SSAU. The specified period will be shorter than the period of production from the SSAU.

At the conclusion of the specified period, a request for discontinuation of reporting will be submitted with a demonstration that current monitoring and model(s) show that the cumulative mass of CO_2 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 SSAU is collected for use in reservoir modeling and operations management. Reservoir pressure is not forecast to change appreciably because the IWR will be maintained at approximately 1.0. The reservoir model shows that by the end of CO_2 injection, average reservoir pressure will be approximately 2,790 psi. Once injection ceases, reservoir pressure is predicted to stabilize within one year. Over time, reservoir pressure is expected to decline 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.

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

In the 84 years since the SSAU oilfield 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 CO_2 to the surface, including:

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

1. Existing Wellbores,
2. Faults and Fractures,
3. Natural and Induced Seismic Activity,
4. Previous Operations,
5. Pipeline/Surface Equipment,
6. Lateral Migration Outside the SSAU,
7. Drilling Through the CO_2 Area, and
8. 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 CO_2 flooding, an extensive review of all SSAU penetrations was completed to determine the need for any corrective action. That analysis showed that all penetrations have either been adequately plugged and abandoned or, if still in use, do not require corrective action. All wells Oxy constructed and operates in the SSAU are in compliance with TRRC rules.

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

- CO_2 flood beam-pumped wells,
- Electrical submersible pump (ESP) producer wells,
- Naturally flowing producer wells,
- Hydraulic jet pump producer wells,
- CO_2 WAG injector wells, and
- Water injectors.

A risk assessment undertaken for SSAU classified all risks associated with the subsurface as low risk, i.e., less than 1% likelihood to occur and having a consequence that is insubstantial, which is less than 1% of injected volume during the duration of the event. The risks were classified as low risk because the SSAU geology is well suited to CO_2 sequestration with an extensive confining zone that is free of fractures and faults that could be potential conduits for CO_2 migration. The low risk is supported by the results of the reservoir model, which shows that stored CO_2 is not predicted to leave the SSAU boundary. Any risks are further mitigated because the SSAU is operated in a manner that maintains, monitors, and documents the integrity of the reservoir.

The risk of well leakage is mitigated through:

- Adhering to regulatory requirements for well drilling and testing;
- Implementing best practices Oxy has developed through its extensive operating experience;
- Monitoring injection and production performance, wellbores, and the surface; and,

- Maintaining surface and subsurface equipment.

Continual and routine monitoring of the wellbores and site operations will be used to detect leaks or other potential well problems, as follows, and as discussed in Section 6.1.5 below:

- Pressure in injection wells is monitored on a continual basis. The injection plans for each pattern are programmed into the injection WAG skids to govern the rate, pressure, and duration of either water or CO_2 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 an 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 CO_2 EOR projects, is that such leakage is very rare, and there have been no incidents of fluid migration out of the intended zone at SSAU.
- Production well performance is monitored using the production well tests, when produced fluids are gathered and sent to a 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 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 CO_2 flooding efficiency is optimized. Production well performance that does not meet planned performance is investigated and any identified issues are addressed. Leakage to the outside of production wells is not considered a major risk because reduced pressure in the casing will prevent leakage outside the wellbore. Further, the personal H_2S monitors are designed to detect the presence of leaked fluids around production wells during well inspections.
- Field inspections are conducted on a routine basis by field personnel. CO_2 leaking through an orifice is cold and leads to formation of bright white clouds and ice that are easily spotted. All field personnel are trained to identify leaking CO_2 and other potential problems at wellbores and in the field. Any CO_2 Surface Leakage detected will be documented and reported and quantified.

Based on ongoing monitoring activities and review of the potential leakage risks posed by wellbores, Oxy concludes that the risk of CO_2 Surface Leakage through wellbores is being mitigated by continuous monitoring and by promptly responding to any detected problems as they arise. Any mass of CO_2 Surface Leakage that occurs will be quantified.

5.2 Faults and Fractures

After reviewing geologic and seismic data, Oxy concluded that there are no known faults or fractures that transect the San Andres Formation in the project area. As a result, there is no risk of CO_2 Surface Leakage due to known fractures or faults.

Oxy manages injections patterns to ensure that the injection pressure does not exceed formation parting pressure (FPP) and does not induce faults of fractures. Oxy routinely measures and updates

FPP and reservoir pressure. Oxy also maintains an IWR at or near 1.0. These practices mitigate the potential for CO_2 injection to induce faults or fractures. As a safeguard, WAG skids are continuously monitored and equipped with automatic shutoff controls should injection pressures exceed programmed settings.

5.3 Natural or Induced Seismicity

After reviewing the literature and actual operating experience, Oxy concluded that there is no direct evidence that natural seismic activity poses a significant risk for loss of CO_2 to the surface in the Permian Basin, specifically in the SSAU.

To evaluate the potential seismic risk at SSAU, Oxy 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 seismic events are judged to be from natural causes. Others are near oilfields or water disposal wells and are placed in the category of "quakes in close association with human enterprise."[4] In December 2022, Oxy reviewed the United States Geological Survey (USGS) database of recorded earthquakes at M3.0 or greater in the Permian Basin and found that none have occurred at or near the SSAU. The nearest recorded earthquake occurred in 1992 and was located approximately 30 miles away. Oxy also participates in the TexNet seismic monitoring network[5] and will continue to monitor for seismic signals that could indicate the creation of potential leakage pathways in SSAU.

The absence of any M3.0 or greater seismic events at or near SSAU indicates that Oxy's injection operations at SSAU do not induce seismicity. Also, natural seismicity is not significant in the area. Therefore, Oxy concludes there is no likely seismicity pathway for CO_2 Surface Leakage.

In addition, Oxy is not aware of any reported loss of injectant (brine water or CO_2) to the surface above SSAU associated with any seismic activity. If induced seismicity resulted in a pathway for material amounts of CO_2 to migrate from the injection zone, Oxy's other reservoir fluid monitoring provisions (e.g., reservoir pressure, well pressure, and pattern monitoring) would detect the migration and lead to further investigation.

5.4 Previous Operations

CO_2 flooding was initiated in SSAU in 1983. To obtain permits for CO_2 flooding, the AoR around all CO_2 injector wells was evaluated for the presence of any known and unknown penetrations and to assess if corrective actions were required. As indicated in Section 5.1, this evaluation reviewed the identified penetrations and determined that no additional corrective actions were 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. Throughout its CO_2 EOR operations, Oxy's constructs wells with materials that are designed to be compatible with CO_2 injection. These practices ensure that there are no unknown penetrations within SSAU and that the risk of a release from legacy wells has been evaluated (as already indicated, no

[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

corrective actions were required). Oxy's continuous monitoring program, described above in section 5.1, further mitigates the risk of a CO_2 Surface Leakage from the identified penetrations. The successful experience with CO_2 flooding in SSAU demonstrates that the confining zone has not been impaired by previous operations.

5.5 Pipelines and Surface Equipment

As part of routine risk management described in Section 5.1, the potential risk of Surface Leakage associated with the following were identified and evaluated:

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

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

The risk of pipeline and surface equipment leakage is mitigated through:

- Adhering to regulatory requirements for well drilling and testing;
- Implementing best practices Oxy has developed through its extensive operating experience;
- Monitoring injection and production performance, wellbores, and the surface; and,
- Maintaining subsurface and surface equipment.

Personnel continuously monitor the pipeline using the Supervisory Control and Data Acquisition (SCADA) system and can 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 CO_2 EOR projects in the oil and gas industry. Operating and maintenance practices currently follow and will continue to follow demonstrated industry standards. CO_2 delivery via the Permian Basin CO_2 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 Surface Leakage be detected from pipeline or surface equipment, the mass of CO_2 Surface Leakage will be quantified following the requirements of Subpart W of EPA's Greenhouse Gas Reporting Program (GHGRP).

5.6 Lateral Migration Outside the SSAU

It is highly unlikely that injected CO_2 will migrate downdip and laterally outside the SSAU because of the nature of the geology and the approach Oxy uses for injection. The SSAU boundary contains a local structural high of the San Andres formation, as well as overlying and underlying formations. As injected CO_2 will rise vertically upward over long periods of time, the SSAU structure forms a

trap configuration that funnels the injected CO_2 towards the crest of the structure, thereby preventing lateral migration beyond the unit boundary. In addition, the planned injection mass and active fluid management during injection operations will prevent CO_2 from migrating laterally out of the structure. Finally, the total mass of fluids contained in the SSAU will stay relatively constant. Based on site characterization and planned and projected operations, it is estimated that the total mass of stored CO_2 will be considerably less than the calculated storage capacity.

5.7 Drilling in the SSAU

The TRRC regulates well drilling activity in Texas. Pursuant to TRRC rules, well casing shall be securely anchored in the hole to control the well effectively at all times, all usable-quality water zones shall be isolated and sealed off effectively to 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 re-entered. Well drilling activity at SSAU is conducted in accordance with TRRC rules. Oxy's visual inspection process, including routine site visits, will identify any unapproved drilling activity in the SSAU.

In addition, Oxy intends to operate SSAU 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 CO_2. Consequently, the risks associated with third parties penetrating the SSAU 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 ensures 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 investigations as to the cause.

5.9 Leakage Detection, Verification, and Quantification

Oxy monitors the potential sources of CO_2 Surface Leakage. Table 3 summarizes the range of identified potential scenarios that could result in CO_2 Surface Leakage, the monitoring activities designed to detect such leakage, and Oxy's standard response.

Table 3—Response Plan for CO_2 Emitted from Surface Leakage

Risk	Monitoring Plan	Response Plan
Tubing Leak	Monitor changes in tubing and annulus pressure; Mechanical Integrity Testing (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 bottomhole pressure control	Blowout during well operations	Expeditiously conduct well kill procedures
Unplanned wells drilled through San Andres	Routine field inspection to prevent unapproved drilling; compliance with TRRC permitting for planned wells	Ensure compliance with TRRC regulations
Loss of seal in abandoned wells	Reservoir pressure in WAG Skids; 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 Skids; high pressure found in new wells	Fluid management along lease lines
Leakage through induced fractures	Reservoir pressure in WAG Skids; high pressure found in new wells	Comply with rules for keeping injection pressures below parting pressure
Leakage due to seismic event	Reservoir pressure in WAG Skids; high pressure found in new wells	Shut in injectors near seismic event, assess reservoir and take corrective action as needed

Given the uncertainty concerning the nature and characteristics of any leaks that may be encountered, Oxy will determine the most appropriate method to quantify the volume of CO_2 using an event-driven process 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. The potential quantification methods may include, but are not limited to:

- For leakage through wellbores, continuous SCADA monitoring data provide the basis to determine duration and the amount of CO_2 loss;
- For leakage from surface equipment and pipelines, continuous SCADA monitoring data and acceptable emission factors, such as those in 40 CFR Part §98 Subpart W, provide the basis to determine duration and the amount of CO_2 loss;
- For leakage related to the competency of the confining layer, reservoir modeling and engineering estimates provide the basis for determining the amount of CO_2 loss.

CO_2 Surface Leakage will be documented, evaluated, and addressed in a timely manner. Records of CO_2 Surface Leakage 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.

5.10 Summary

The structure and stratigraphy of the San Andres reservoir in the SSAU is ideally suited for the injection and storage of CO_2. The stratigraphy within the CO_2 injection zones is porous, permeable, and thick, providing ample capacity for long-term CO_2 storage. The reservoir is overlain by several intervals of impermeable geologic zones that form effective seals for fluids in the reservoir. After assessing the potential risk of release from the subsurface and mitigating the risk of leakage from wellbores, it has been determined that the potential threat of CO_2 Surface Leakage is extremely low.

In summary, based on a careful assessment of the potential risk of release of CO_2 from the subsurface, it has been determined that there are no leakage pathways at the SSAU that are likely to result in CO_2 Surface Leakage. Further, given the detailed knowledge of the field and its operating protocols, it is concluded that in the unlikely event CO_2 leakage to the surface occurs, either through identified or unexpected leakage pathways, it would be detected quickly, quantified, and addressed promptly.

6. Monitoring and Considerations for Calculating Site-Specific Variables

Monitoring will be used to determine the quantities in the mass balance equations and to make the demonstration that the CO_2 plume will not migrate to the surface after CO_2 injection is discontinued.

The first part of this section describes how site-specific monitoring will be used to quantify the variables used in the mass balance equations discussed in Section 8 below. The second part of this section describes the monitoring program in place to collect data for the demonstration that the CO_2 plume will not migrate to the surface and support the request to discontinue monitoring described in Sections 4.3 and 9.

6.1 Variables for the Mass Balance Equation

6.1.1 General Monitoring Procedures

Flow rate, pressure, and CO_2 gas composition data are monitored and collected from the SSAU 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 SSAU follow the prevailing industry standard(s) for custody transfer as currently promulgated by the American Petroleum Institute (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 and calibrated 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 CO_2 Received

Oxy measures the volumetric rate of received CO_2 using a commercial custody transfer meter at the point at which custody of the CO_2 from the Permian Basin CO_2 pipeline delivery system is transferred to the SSAU, marked as flow meter M2 on Figure 5. This meter measures flow rate continually. The transfer is a commercial transaction that is documented. In accordance with §98.444(a)(3)(ii), Oxy uses CO_2 concentration data from the commercial sales contract. No CO_2 is received at the SSAU in containers.

6.1.3 CO_2 Injected in the Subsurface

In accordance with §98.444(b)(1), Oxy measures the flow rate of injected CO_2 using the custody transfer meter M2, on Figure 5, and at the outlet of the SGPP, flow meter M3, on Figure 5. In accordance with §98.444(b)(2), the flow rate will be collected quarterly. In accordance with §98.444(b)(3), CO_2 concentration will be sampled at least once per quarter.

6.1.4 CO_2 Produced and Entrained in Products

In accordance with §98.444(c), Oxy measures CO_2 produced at flow meter M4 on Figure 5, that is located at the outlet of the separation unit that sends the CO_2 stream to the injection wells. CO_2 concentration and flow rates will be collected quarterly.

CO_2 that is entrained (i.e., dissolved) in produced oil and natural gas, as indicated in Figure 5, is measured using volumetric flow through the custody transfer meters (M5 and M6).

6.1.5 CO_2 from Equipment Leaks and Vented Emissions of CO_2

In accordance with §98.444(d), Oxy uses 40 CFR §98 Subpart W to estimate the mass of CO_2 emitted from equipment leaks at the SSAU. In accordance with §98.446(f)(3), Oxy will report CO_{2FI} and CO_{2FP}.

6.2 Detection and Quantification of CO_2 Surface Leakage

Oxy uses a multi-layered, risk-based monitoring program for event-driven incidents designed to meet two objectives: 1) to detect problems before CO_2 is emitted by Surface Leakage; and 2) to detect and quantify any CO_2 Surface Leakage that does occur. This section discusses how this monitoring will be conducted and used to quantify the mass of CO_2 Surface Leakage.

6.2.1 Monitoring Potential CO_2 Emissions 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 CO_2 Surface Leakage from the subsurface.

Reservoir simulation modeling, confirmed with 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 CO_2 emissions by Surface Leakage may be occurring. Excursions are

not necessarily indicators of Surface Leakage; 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 CO_2 Surface 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 record in the computerized maintenance management system (CMMS). This record enables the tracking of progress on investigating potential leaks and, if CO_2 has been emitted by Surface Leakage, to quantify its magnitude.

Likewise, a forecast of the rate and composition of produced fluids is developed using the reservoir simulation model. Each producer well is assigned to a specific SAT and is isolated during each cycle for a well production test. The data from the test results are 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 will be initiated. As in the case of injection pattern monitoring, if the investigation leads to a work order in the CMMS, this record will provide the basis for tracking the outcome of the investigation and if a leak has occurred, recording the quantity Surface Leakage. If a CO_2 release in the flood zone were detected, an investigation would be conducted that would include an appropriate method to quantify the mass of any CO_2 confirmed to have been emitted by Surface Leakage. This might include use of material balance equations based on known injected quantities and monitored pressures in the injection zone to estimate the mass of CO_2 involved.

Generally, it is highly unlikely that a subsurface release at SSAU will lead to CO_2 Surface Leakage. In the unlikely event that there are indications of a potential subsurface release, Oxy would determine the appropriate approach for tracking subsurface release to determine whether there was a risk of CO_2 Surface Leakage, address and remedy the release and quantify any actual CO_2 Surface Leakage. To quantify CO_2 Surface Leakage, the relevant parameters (e.g., the rate, concentration, and duration of CO_2 Surface Leakage) would be either be directly measured or estimated to quantify the release mass. Depending on specific circumstances, these determinations may rely on engineering estimates.

In the event a release from the subsurface occurred diffusely through the seals to the surface, the CO_2 Surface Leakage would necessarily include H_2S, which is also present in the SSAU, which would trigger the alarm on the personal monitors worn by field personnel. CO_2 Leakage from the subsurface to the surface have not occurred in the SSAU. If CO_2 Surface Leakage was detected, personnel would use modeling, engineering estimates, and direct measurements to assess, address, and quantify the mass of CO_2 Surface Leakage.

6.2.2. Monitoring of Wellbores

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

CO_2 Surface Leakage from wellbores would be detected through the follow-up investigation of pressure anomalies, visual inspection, or the use of personal H_2S monitors.

Anomalies in injection zone pressure may not indicate CO_2 Surface Leakage. However, if an investigation leads to a work order, field personnel would inspect the equipment in question and determine the nature of the problem. Where possible, repairs will be made with materials on hand and the mass of CO_2 Surface Leakage would be included in the 40 CFR Part §98 Subpart W report for the SSAU. If repairs require additional time and materials, the appropriate approach for quantifying mass of CO_2 Surface Leakage using the relevant parameters (e.g., the rate, concentration, and duration) 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 any identified issues. Where possible, repairs will be made with materials on hand at the time of inspection and the mass of CO_2 Surface Leakage would be included in the 40 CFR Part §98 Subpart W report for SSAU. If repairs require additional time and materials, the affected well would be shut in, a work order would be generated, and the appropriate approach for quantifying the mass of CO_2 Surface Leakage using the relevant parameters (e.g., the rate, concentration, and duration) would be determined. The work order would serve as the basis for tracking the event for GHG reporting.

Because a CO_2 release 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 SSAU is employed to detect unexpected releases from wellbores and surface facilities. 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 CO_2 emissions.

Finally, the data collected by the H_2S monitors, which are always worn by all field personnel, are used as an additional method to detect CO_2 Surface Leakage from wellbores. The H_2S monitors' detection limit is 10 ppm; if an H_2S 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, H_2S is considered a proxy for potential CO_2 Surface Leakage in the field; thus, detected H_2S will be investigated to determine any if confirmed CO_2 Surface Leakage is occurring. If the incident results in a work order, this will serve as the basis for tracking the event for GHG reporting.

6.2.3. Other Potential CO_2 Emissions by Surface Leakage

The same visual inspection process and H_2S monitoring system for identifying potential CO_2 Surface Leakage s from wellbores will be used to detect other potential CO_2 Surface Leakage. Routine visual inspections are used to detect CO_2 Surface Leakage. 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 conducting a general observation of the facility for visible CO_2 emissions. If problems are detected, field personnel would investigate, and, if maintenance is required, generate a work order in the CMMS, which is tracked through completion. In addition to these visual inspections, the results of the personal H_2S monitors worn by field personnel will be used as a supplement to identify CO_2 Surface Leakage that may escape visual detection.

If CO_2 Surface Leakage are detected, they will be reported to surface operations personnel, who will review the reports and conduct a site investigation. If maintenance is required, steps will be taken to prevent further emissions, and a work order will be generated in the CMMS. The work order will describe the appropriate corrective action and be used to track completion of the maintenance action. It will also serve as the basis for tracking the event for GHG reporting and quantifying the mass of CO_2 Surface Leakage.

6.3. Monitoring to Demonstrate that Injected CO_2 Is Not Expected to Migrate to the Surface

At the end of the specified period, Oxy will cease injecting CO_2 for the subsidiary purpose of establishing the long-term storage of CO_2 in the SSAU. Sometime 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 CO_2 reported under 40 CFR §98.440-449 (Subpart RR) is not expected to migrate in the future in a manner likely to result in CO_2 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:

- Data comparing actual performance to predicted performance (purchase, injection, production) over the monitoring period;
- An assessment of the CO_2 Surface Leakage detected, including discussion of the estimated mass of CO_2 emitted and the distribution of emissions by Surface Leakage pathway;
- A demonstration that future operations will not release the injected CO_2 to the surface;
- A demonstration that there has been no significant CO_2 emissions by Surface Leakage; and,
- An evaluation of reservoir pressure that demonstrates that injected fluids are not expected to migrate in a manner to likely to result in Surface Leakage.

7. Determination of Baselines

Existing automatic data systems will be utilized to identify and investigate excursions from expected performance that could indicate CO_2 emissions from the SSAU. Data systems are used primarily for operational control and monitoring and thus 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 CO_2 Surface Leakage will be developed. The following describes the approach to collecting this information.

7.1 Visual Inspections

As field personnel conduct routine inspections, work orders are generated in the CMMS for maintenance activities that cannot be addressed on the spot. Methods to capture work orders that involve activities that could potentially involve CO_2 Surface 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 mass of CO_2 Surface Leakage. Records of information used to calculate emissions will be maintained on file for a minimum of three years.

7.2 Personal H_2S Monitors

Oxy's injection gas compositional analysis indicates H_2S is approximately 1% of the total injected fluid stream. H_2S monitors are worn by all field personnel. The H_2S monitors detect concentrations of H_2S up to 500 ppm in 0.1 ppm increments and will sound an alarm if the detection limit exceeds 10 ppm. If an H_2S 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 H_2S to be a proxy for identifying CO_2 Surface Leakage. The person responsible for MRV documentation will receive notice of all incidents where H_2S 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 of the mass of CO_2 confirmed emitted from any such incidents. Records of information to calculate emissions will be maintained on file for a minimum of three years.

7.3 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 reservoir modeling. The injection targets are programmed into the WAG satellite controllers. High and low set points are also programmed into the controllers, and flags are generated whenever statistically significant deviations from these 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 lead to CO_2 Surface Leakage. The person responsible for the MRV documentation will receive notice of excursions and related work orders that could potentially involve CO_2 Surface Leakage. The Annual Subpart RR Report will provide an estimate of the mass of CO_2 confirmed Surface Leakage. Records of information used to calculate emissions will be maintained on file for a minimum of three years.

7.4 Production Volumes and Compositions

A general forecast of production volumes and composition is developed and used to evaluate performance periodically and refine current and projected injection plans and the forecast. This information is used to make operational decisions, but it is not recorded in an automated data system. Sometimes, this review may result in the generation of a work order in the CMMS. The MRV plan implementation lead will review such work orders and identify those that could result in CO_2 Surface Leakage. Should such events occur, the mass of CO_2 confirmed Surface Leakage 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

This section describes how Oxy uses the equations in Subpart RR §98.443 to calculate the mass of CO_2 received using equations RR-2 and RR-3, the mass of CO_2 injected using equations RR-5

and RR-6, the amount of CO_2 produced using equations RR-8 and RR-9, the mass of CO_2 Surface Leakage using equation RR-10, and the mass of CO_2 sequestered using equation RR-11.

8.1 Mass of CO_2 Received

In accordance with §98.443, Equation RR-2 will be used to calculate the mass of CO_2 Received. In accordance with the requirements at Subpart RR §98.444(a), CO_2 will be measured at the custody transfer meter from the Permian Basin CO_2 pipeline delivery system (M2 on Figure 5). Because there is no redelivery of CO_2, $S_{r,p}$ will be zero ("0"). Quarterly CO_2 concentration will be taken from the gas measurement database. The volumetric flow at standard conditions will be multiplied by the CO_2 concentration and the density of CO_2 at standard conditions to determine net Annual Mass of CO_2 Received.

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

Where:

$CO_{2T,r}$ = Net annual mass of CO_2 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 CO_2 at standard conditions (metric tons per standard cubic meter), 0.0018682;

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

p = Quarter of the year; and

r = Receiving flow meters.

In accordance with §98.443, Equation RR-3 will be used to sum the mass of CO_2 received from all flow meters is calculated in the following equation.

$$CO_2 = \sum_{r=1}^{R} CO_{2T,r} \quad \text{(Eq. RR-3)}$$

Where:

CO_2 = Total net annual mass of CO_2 received (metric tons).

$CO_{2T,r}$ = Net annual mass of CO_2 received through flow meter r (metric tons).

8.2 Mass of CO_2 Injected into the Subsurface

As described in Section 6.1.3, the amount of CO_2 injected is measured at M2 and M3. In accordance with §98.443, Equation RR-5 will be used to calculate the mass of CO_2 flowing through each of these meters. Quarterly CO_2 concentration will be taken from the gas measurement database. The volumetric flow at standard conditions will be multiplied by the CO_2 concentration and the density of CO_2 at standard conditions to determine net Annual Mass of CO_2 Received.

$$CO_{2,u} = \sum_{p=1}^{4} Q_{p,u} * D * C_{CO2,p,u} \qquad \text{(Eq. RR-5)}$$

Where:

$CO_{2,u}$ = Annual CO_2 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 CO_2 at standard conditions (metric tons per standard cubic meter), 0.0018682;

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

p = Quarter of the year; and

u = Flow meter.

In accordance with §98.443, Equation RR-6 will be used to calculate the total Mass of CO_2 Injected, which is the sum of the Mass of CO_2 from flow meters M2 and M3.

$$CO_{2I} = \sum_{u=1}^{U} CO_{2,u} \qquad \text{(Eq. RR-6)}$$

Where:

$CO_{2,u}$ = Annual CO_2 mass recycled (metric tons) as measured by flow meter u + Net annual mass of CO_2 received through flow meter r (metric tons).

8.3 Mass of CO_2 Produced

In accordance with §98.443, Equation RR-8 will be used the calculate the Mass of CO_2 Produced at flow meter M4 on Figure 5, as described in Section 6.1.4. Quarterly CO_2 concentration will be taken from the gas measurement database. The volumetric flow at standard conditions will be multiplied by the CO_2 concentration and the density of CO_2 at standard conditions to determine net Annual Mass of CO_2 Received.

$$CO_{2w} = \sum_{p=1}^{4} Q_{p,w} * D * C_{CO2,p,w} \quad \text{(Eq. RR-8)}$$

Where:

CO_{2w} = Annual CO_2 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 CO_2 at standard conditions (metric tons per standard cubic meter), 0.0018682;

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

p = Quarter of the year; and

w = Separator.

In accordance with §98.443 Equation RR-9, Oxy will calculate the amount of CO_2 entrained in oil at the custody transfer meters for oil sales, M4.

$$CO_{2,p} = (1+X) * \sum_{w=1}^{W} CO_{2,w} \quad \text{(Eq. RR-9)}$$

Where:

$CO_{2,p}$ = Total annual CO_2 mass produced (metric tons) through all meters in the reporting year;

$CO_{2,w}$ = Annual CO_2 mass produced (metric tons) through meter w in the reporting year;

X = Entrained CO_2 in produced oil or other fluid divided by the CO_2 separated through all separators in the reporting year (weight percent CO_2, expressed as a decimal fraction);

w = Separator

8.4 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 events. Oxy is prepared to address the potential for CO_2 Surface Leakage in a variety of settings. Estimates of the mass of confirmed CO_2 Surface Leakage will depend on several site-specific factors including measurements, engineering estimates, and emission factors, depending on the source and nature of the CO_2 Surface Leakage.

The process for quantifying the mass of CO_2 Surface Leakage will entail using best engineering principles or emission factors. While it is not possible to predict in advance all the types of events that may lead to CO_2 Surface Leakage, some approaches for quantification are described in Sections 5.9 and 6. In the event CO_2 Surface Leakage is confirmed the mass of CO_2 Surface Leakage would be quantified and reported, and records that describe the methods used to estimate or measure the mass emitted 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 the mass of CO_2 Surface Leakage are not double-counted.

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

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

Where:

CO_{2E} = Total annual CO_2 mass emitted by Surface Leakage (metric tons) in the reporting year;

CO_{2x} = Annual CO_2 mass emitted (metric tons) at leakage pathway x in the reporting year; and

x = Leakage pathway.

8.5 Mass of CO_2 Sequestered in Subsurface Geologic Formation

In accordance with §98.443, Equation RR-11 will be used to calculate the Mass of CO_2 Sequestered in Subsurface Geologic Formations in the Reporting Year as follows:

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

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.

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.

8.6 Cumulative Mass of CO_2 Reported as Sequestered in Subsurface Geologic Formation

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

9. MRV Plan Implementation Schedule

This MRV plan will be implemented starting January 1, 2023. GHG reports are filed on March 31 of the year after the reporting year, and Oxy anticipates that the Annual Subpart RR Report will be filed at the same time. Oxy anticipates that the MRV program will be in effect during the specified period, during which time one of the operating purposes will be to establish long-term containment of a measurable quantity of CO_2 in subsurface geological formations at the SSAU.

Oxy anticipates that it will be able to demonstrate that a quantifiable mass of CO_2 injected during the specified period will be stored such that it will not migrate in the future in a manner that likely to result in Surface Leakage. At the end of the specified period, 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:

10.1.1 CO_2 Received and Injected

- The quarterly flow rate of CO_2 received by pipeline is measured at the receiving custody transfer meters.
- The quarterly CO_2 flow rate for recycled CO_2 is measured at the flow meter located at the SGPP outlet.

10.1.2 CO_2 Produced

- The point of measurement for the quantity of CO_2 produced from oil or other fluid production wells is a flow meter at the outlet 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 SGPP flow meter used to measure flow rate of the gas stream, and the CO_2 concentration of the sample will be measured.
- The quarterly flow rate of the produced gas is measured at the flow meters located at the SGPP outlet.

10.1.3 CO_2 Emissions from Equipment Leaks and Vented Emissions of CO_2

The mass of CO_2 emitted from equipment leaks and vented emissions are measured in conformance with the monitoring and QA/QC requirements specified in Subpart W of 40 CFR Part §98.

10.1.4 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 either industry standard practices or an appropriate standard method published by a consensus-based standards organization; and,
- Calibrated, when necessary, using National Institute of Standards and Technology (NIST) methods that are traceable.

10.1.5 Concentration of CO_2

CO_2 concentration is measured using an industry standard practice or an appropriate standard method. Further, all measured CO_2 has been converted to standard cubic meters at a temperature of 60°F 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 CO_2 received that is missing will be estimated using invoices or using a representative flow rate value from the nearest previous time period.
- A quarterly CO_2 concentration of a CO_2 stream received that is missing will be estimated using invoices or using a representative concentration value from the nearest previous time period.
- A quarterly quantity of CO_2 injected that is missing will be estimated using a representative quantity of CO_2 injected from the nearest previous time period at a similar injection pressure.
- For any values associated with CO_2 emissions from equipment leaks and vented emissions of CO_2 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 will be followed.
- The quarterly quantity of CO_2 produced from subsurface geologic formations that is missing will be estimated using a representative quantity of CO_2 produced from the nearest previous time period.

10.3 MRV Plan Revisions

Within 180 days of a material change to the monitoring and/or operational parameters of the CO_2 EOR operations in the SSAU that is not anticipated in this MRV plan, a change in UIC permit class, EPA notification of substantive errors in this MRV plan or monitoring report, or if Oxy chooses to revise this MRV plan, the MRV plan will be revised and submitted to the EPA Administrator 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 CO_2 received at standard conditions and operating conditions, operating temperature and pressure, and concentration of these streams.
- Quarterly records of produced CO_2, including volumetric flow at standard conditions and operating conditions, operating temperature and pressure, and concentration of these streams.
- Quarterly records of injected CO_2 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 CO_2 emitted by Surface Leakage.
- 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 flow meter used to measure injection quantity and the injection wellhead.
- 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 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

Table 4 presents the well name and number, API number, type, and status for active wells in SSAU 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 CO_2 gas.
  - INJ_WAG refers to wells that inject water and CO_2 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.

Table 4—SSAU Well Numbers, Types, and Status

The Well Name & Number, API Number, Well Type, and Well Status are all from OXYODS.MDMODS.Well_All. They include only Oxy Operated wells with a field name like SEMINOLE (SAN ANDRES).

Well Name & Number from OXYODS	API Number	Well Type	Well Status as of November 2022
SSAU-3901	42165000220000	INJ_WAG	ACTIVE
SSAU-1301	42165000230000	PROD_OIL	ACTIVE
SSAU-0701	42165000240000	PROD_OIL	ACTIVE
SSAU-3902	42165000250000	INJ_WAG	ACTIVE
SSAU-1302	42165000260000	INJ_WAG	ACTIVE
SSAU-0702	42165000270000	INJ_WAG	ACTIVE
SSAU-3903	42165000290000	PROD_OIL	P & A
SSAU-1303	42165000300000	PROD_OIL	TA
SSAU-0703	42165000310000	PROD_OIL	ACTIVE
SSAU-3904	42165000320000	PROD_OIL	ACTIVE
SSAU-1304	42165000330000	PROD_OIL	ACTIVE
SSAU-0704	42165000340000	PROD_OIL	P & A
SSAU-3905W	42165000350000	INJ_WAG	ACTIVE
SSAU-0705	42165000360000	PROD_OIL	ACTIVE
SSAU-3906	42165000370000	PROD_OIL	ACTIVE
SSAU-1306	42165000380000	INJ_WAG	ACTIVE
SSAU-0706	42165000390000	INJ_H2O	ACTIVE
SSAU-3907	42165000400000	PROD_OIL	ACTIVE
SSAU-0707	42165000410000	INJ_H2O	ACTIVE
SSAU-3908	42165000420000	INJ_WAG	ACTIVE
SSAU-1102	42165000520000	INJ_WAG	P & A
SSAU-1202	42165000650000	PROD_OIL	ACTIVE
SSAU-3602	42165000660000	PROD_OIL	TA
SSAU-4801	42165000670000	PROD_OIL	ACTIVE
SSAU-1201	42165000690000	INJ_H2O	P & A
SSAU-4302	42165000720000	PROD_OIL	ACTIVE
SSAU-4303W	42165000730000	INJ_WAG	ACTIVE
SSAU-4304	42165000740000	INJ_WAG	ACTIVE
SSAU-4305	42165000750000	INJ_WAG	ACTIVE
SSAU-4306	42165000760000	INJ_WAG	ACTIVE
SSAU-4307	42165000770000	INJ_WAG	ACTIVE
SSAU-4308	42165000780000	INJ_WAG	ACTIVE
SSAU-4309	42165000790000	PROD_OIL	TA
SSAU-0401	42165000820000	INJ_H2O	ACTIVE

SSAU-0501	42165000830000	INJ_H2O	ACTIVE
SSAU-0402	42165000840000	PROD_OIL	P & A
SSAU-0502	42165000850000	PROD_OIL	ACTIVE
SSAU-0801	42165000980000	PROD_OIL	ACTIVE
SSAU-3501W	42165000990000	INJ_H2O	TA
SSAU-3502	42165001000000	PROD_OIL	ACTIVE
SSAU-3503	42165001010000	INJ_WAG	ACTIVE
SSAU-3504	42165001020000	INJ_WAG	SHUT-IN
SSAU-3505	42165001030000	INJ_WAG	ACTIVE
SSAU-3506	42165001040000	PROD_OIL	TA
SSAU-3507W	42165001050000	INJ_WAG	ACTIVE
SSAU-3508	42165001060000	PROD_OIL	ACTIVE
SSAU-3509	42165001070000	INJ_WAG	SHUT-IN
SSAU-3510	42165001080000	INJ_WAG	TA
SSAU-3511	42165001090000	INJ_WAG	ACTIVE
SSAU-3512	42165001100000	PROD_OIL	P & A
SSAU-3513W	42165001110000	INJ_WAG	ACTIVE
SSAU-3514	42165001120000	INJ_WAG	ACTIVE
SSAU-3515	42165001130000	PROD_OIL	P & A
SSAU-3516	42165001140000	PROD_OIL	TA
SSAU-6401	42165001700000	PROD_OIL	ACTIVE
SSAU-6402	42165001710000	INJ_WAG	ACTIVE
SSAU-6403	42165001720000	PROD_OIL	ACTIVE
SSAU-6404	42165001730000	PROD_OIL	ACTIVE
SSAU-6405	42165001740000	PROD_OIL	ACTIVE
SSAU-6406W	42165001750000	INJ_H2O	TA
SSAU-6407	42165001760000	PROD_OIL	ACTIVE
SSAU-2401W	42165001880000	INJ_WAG	ACTIVE
SSAU-2402	42165001890000	PROD_OIL	ACTIVE
SSAU-2403	42165001900000	PROD_OIL	ACTIVE
SSAU-2404	42165001910000	INJ_WAG	ACTIVE
SSAU-6001	42165001920000	PROD_OIL	TA
SSAU-5301	42165001930000	INJ_WAG	ACTIVE
SSAU-5302	42165001940000	PROD_OIL	ACTIVE
SSAU-5303	42165001950000	PROD_OIL	ACTIVE
SSAU-5304W	42165001960000	INJ_WAG	ACTIVE
SSAU-5305	42165001970000	INJ_WAG	ACTIVE
SSAU-5306	42165001980000	PROD_OIL	ACTIVE
SSAU-5307	42165001990000	PROD_OIL	ACTIVE
SSAU-5308W	42165002000000	INJ_WAG	P & A
SSAU-2701	42165002040000	INJ_WAG	ACTIVE

SSAU-2702	42165002050000	PROD_OIL	ACTIVE
SSAU-2703W	42165002060000	INJ_WAG	ACTIVE
SSAU-2704W	42165002070000	INJ_WAG	ACTIVE
SSAU-2705	42165002080000	PROD_OIL	ACTIVE
SSAU-2706	42165002090000	PROD_OIL	ACTIVE
SSAU-2707	42165002160000	INJ_WAG	ACTIVE
SSAU-2708	42165002170000	PROD_OIL	ACTIVE
SSAU-0601	42165002270000	INJ_H2O	ACTIVE
SSAU-4001	42165002290000	PROD_OIL	P & A
SSAU-1401	42165002300000	PROD_OIL	ACTIVE
SSAU-3701	42165002310000	INJ_WAG	ACTIVE
SSAU-4002W	42165002320000	INJ_WAG	ACTIVE
SSAU-1402W	42165002330000	INJ_H2O	P & A
SSAU-3702	42165002340000	PROD_OIL	ACTIVE
SSAU-4003	42165002350000	INJ_H2O	P & A
SSAU-1403	42165002360000	INJ_WAG	ACTIVE
SSAU-4004	42165002370000	PROD_OIL	ACTIVE
SSAU-1404	42165002380000	PROD_OIL	ACTIVE
SSAU-4005	42165002390000	INJ_H2O	P & A
SSAU-1405	42165002400000	PROD_OIL	ACTIVE
SSAU-4006	42165002410000	PROD_OIL	ACTIVE
SSAU-1406	42165002420000	INJ_WAG	ACTIVE
SSAU-4007	42165002430000	PROD_OIL	INACTIVE
SSAU-1407	42165002440000	PROD_OIL	ACTIVE
SSAU-4008	42165002450000	INJ_WAG	ACTIVE
SSAU-1408	42165002460000	INJ_H2O	P & A
SSAU-3601	42165002520000	INJ_H2O	TA
SSAU-1504	42165002570000	PROD_OIL	ACTIVE
SSAU-1505W	42165002580000	INJ_WAG	P & A
SSAU-1506	42165002590000	INJ_WAG	ACTIVE
SSAU-1507	42165002600000	PROD_OIL	ACTIVE
SSAU-5901	42165002630000	PROD_OIL	ACTIVE
SSAU-5902	42165002640000	PROD_OIL	TA
SSAU-3801	42165002690000	INJ_WAG	INACTIVE
SSAU-3802	42165002700000	PROD_OIL	INACTIVE
SSAU-3803	42165002710000	PROD_OIL	P & A
SSAU-3804	42165002720000	PROD_OIL	ACTIVE
SSAU-3805	42165002730000	PROD_OIL	INACTIVE
SSAU-3806	42165002740000	INJ_H2O	ACTIVE
SSAU-1901	42165002800000	PROD_OIL	ACTIVE
SSAU-1902	42165002820000	INJ_WAG	ACTIVE

SSAU-1903	42165002830000	PROD_OIL	ACTIVE
SSAU-1904	42165002840000	PROD_OIL	ACTIVE
SSAU-1905A	42165002850000	PROD_OIL	ACTIVE
SSAU-3301	42165002920000	INJ_WAG	P & A
SSAU-3302	42165002930000	PROD_OIL	ACTIVE
SSAU-3303	42165002940000	INJ_WAG	INACTIVE
SSAU-3304	42165002950000	PROD_OIL	ACTIVE
SSAU-1801	42165003180000	INJ_WAG	ACTIVE
SSAU-1305	42165003400000	PROD_OIL	P & A
SSAU-6408	42165003410000	INJ_H2O	ACTIVE
SSAU-0201	42165003420000	PROD_OIL	TA
SSAU-0202	42165003430000	INJ_H2O	INACTIVE
SSAU-5101	42165003440000	INJ_WAG	ACTIVE
SSAU-5102	42165003450000	INJ_WAG	ACTIVE
SSAU-5103	42165003460000	PROD_OIL	ACTIVE
SSAU-1501	42165003620000	PROD_OIL	ACTIVE
SSAU-1502	42165003630000	INJ_WAG	ACTIVE
SSAU-1503	42165003690000	PROD_OIL	TA
SSAU-6301	42165003870000	PROD_OIL	ACTIVE
SSAU-6302	42165003880000	PROD_OIL	ACTIVE
SSAU-6303	42165003890000	PROD_OIL	ACTIVE
SSAU-6304	42165003900000	INJ_WAG	ACTIVE
SSAU-6305	42165003910000	INJ_H2O	ACTIVE
SSAU-6306	42165003920000	PROD_OIL	ACTIVE
SSAU-6307	42165003930000	INJ_H2O	ACTIVE
SSAU-6308	42165003940000	PROD_OIL	INACTIVE
SSAU-7301	42165004090000	PROD_OIL	ACTIVE
SSAU-7302	42165004100000	PROD_OIL	ACTIVE
SSAU-8201	42165004110000	PROD_OIL	INACTIVE
SSAU-8202	42165004120000	PROD_OIL	P & A
SSAU-8203	42165004130000	PROD_OIL	P & A
SSAU-7701	42165004140000	PROD_OIL	ACTIVE
SSAU-7702	42165004150000	INJ_H2O	ACTIVE
SSAU-8101	42165004160000	PROD_OIL	INACTIVE
SSAU-8102	42165004170000	PROD_OIL	ACTIVE
SSAU-8103	42165004180000	PROD_OIL	INACTIVE
SSAU-8104	42165004190000	INJ_H2O	ACTIVE
SSAU-7401W	42165004230000	INJ_H2O	P & A
SSAU-6101	42165004240000	PROD_OIL	ACTIVE
SSAU-4501	42165008710000	PROD_OIL	P & A
SSAU-8401	42165009570000	INJ_H2O	P & A

SSAU-5601	42165009880000	PROD_OIL	ACTIVE
SSAU-5602	42165009890000	PROD_OIL	P & A
SSAU-5603	42165009900000	PROD_OIL	P & A
SSAU-3001	42165011170000	PROD_OIL	INACTIVE
SSAU-0301	42165011180000	PROD_OIL	P & A
SSAU-3401W	42165011950000	INJ_WAG	ACTIVE
SSAU-3402	42165012040000	PROD_OIL	ACTIVE
SSAU-3403	42165012050000	PROD_OIL	ACTIVE
SSAU-3404	42165012060000	INJ_WAG	ACTIVE
SSAU-2807	42165012130000	PROD_OIL	ACTIVE
SSAU-2808	42165012140000	INJ_WAG	ACTIVE
SSAU-1601	42165012320000	INJ_WAG	ACTIVE
SSAU-1602	42165012330000	PROD_OIL	ACTIVE
SSAU-1603	42165012340000	PROD_OIL	ACTIVE
SSAU-1604	42165012350000	INJ_WAG	ACTIVE
SSAU-1605	42165012360000	PROD_OIL	ACTIVE
SSAU-1606W	42165012370000	INJ_WAG	ACTIVE
SSAU-1607	42165012380000	PROD_OIL	ACTIVE
SSAU-1608	42165012390000	INJ_WAG	ACTIVE
SSAU-2601	42165012430000	PROD_OIL	P & A
SSAU-2501	42165012770000	PROD_OIL	ACTIVE
SSAU-2801	42165012830000	PROD_OIL	P & A
SSAU-2802	42165012840000	INJ_WAG	SHUT-IN
SSAU-2803	42165012850000	PROD_OIL	ACTIVE
SSAU-2804	42165012860000	INJ_WAG	ACTIVE
SSAU-2805W	42165012870000	INJ_WAG	ACTIVE
SSAU-2806	42165012880000	PROD_OIL	ACTIVE
SSAU-0903	42165014280000	INJ_WAG	P & A
SSAU-0902	42165014290000	PROD_OIL	P & A
SSAU-0901W	42165014300000	INJ_WAG	P & A
SSAU-5701	42165014410000	PROD_OIL	P & A
SSAU-0101	42165015120000	INJ_H2O	TA
SSAU-2001	42165015590000	PROD_OIL	P & A
SSAU-0102	42165015620000	PROD_OIL	P & A
SSAU-2202	42165015770000	PROD_OIL	ACTIVE
SSAU-7512	42165015790000	PROD_OIL	P & A
SSAU-5516	42165015800000	INJ_WAG	ACTIVE
SSAU-4101	42165017730000	INJ_WAG	ACTIVE
SSAU-6501	42165017790000	PROD_OIL	P & A
SSAU-6502	42165017800000	INJ_H2O	P & A
SSAU-6503	42165017810000	PROD_OIL	P & A

SSAU-7501	42165017830000	PROD_OIL	ACTIVE
SSAU-7502	42165017840000	PROD_OIL	INACTIVE
SSAU-7503	42165017850000	PROD_OIL	P & A
SSAU-7504	42165017860000	PROD_OIL	ACTIVE
SSAU-7505	42165017870000	PROD_OIL	ACTIVE
SSAU-7506W	42165017880000	INJ_H2O	ACTIVE
SSAU-7507W	42165017890000	INJ_H2O	ACTIVE
SSAU-7508	42165017900000	PROD_OIL	ACTIVE
SSAU-7509	42165017910000	PROD_OIL	INACTIVE
SSAU-7510	42165017920000	PROD_OIL	ACTIVE
SSAU-7511	42165017930000	INJ_H2O	ACTIVE
SSAU-5501	42165017940000	PROD_OIL	ACTIVE
SSAU-5502	42165017950000	INJ_WAG	ACTIVE
SSAU-5503	42165017960000	PROD_OIL	P & A
SSAU-5504W	42165017970000	INJ_WAG	ACTIVE
SSAU-5505	42165017980000	PROD_OIL	P & A
SSAU-5506	42165017990000	INJ_WAG	ACTIVE
SSAU-5507	42165018000000	PROD_OIL	ACTIVE
SSAU-5508	42165018010000	INJ_WAG	ACTIVE
SSAU-5509	42165018020000	INJ_WAG	ACTIVE
SSAU-5510	42165018030000	PROD_OIL	ACTIVE
SSAU-5511W	42165018040000	INJ_WAG	ACTIVE
SSAU-5512	42165018050000	PROD_OIL	P & A
SSAU-5513	42165018060000	PROD_OIL	TA
SSAU-5514	42165018070000	PROD_OIL	P & A
SSAU-5515	42165018080000	PROD_OIL	P & A
SSAU-2901	42165018090000	PROD_OIL	ACTIVE
SSAU-2902	42165018100000	INJ_WAG	ACTIVE
SSAU-2903	42165018110000	PROD_OIL	P & A
SSAU-2904W	42165018120000	INJ_WAG	ACTIVE
SSAU-2905	42165018130000	INJ_WAG	SHUT-IN
SSAU-2906	42165018140000	INJ_WAG	ACTIVE
SSAU-2907	42165018150000	PROD_OIL	ACTIVE
SSAU-2908	42165018160000	INJ_WAG	ACTIVE
SSAU-2909	42165018170000	INJ_WAG	TA
SSAU-2910	42165018180000	PROD_OIL	ACTIVE
SSAU-2911	42165018190000	PROD_OIL	TA
SSAU-2912	42165018200000	PROD_OIL	ACTIVE
SSAU-2913W	42165018210000	INJ_H2O	INACTIVE
SSAU-2914	42165018220000	INJ_H2O	ACTIVE
SSAU-4102	42165018230000	PROD_OIL	ACTIVE

SSAU-4103	42165018240000	PROD_OIL	ACTIVE
SSAU-4104W	42165018250000	INJ_WAG	ACTIVE
SSAU-4105	42165018260000	PROD_OIL	ACTIVE
SSAU-4106	42165018270000	PROD_OIL	TA
SSAU-4107	42165018280000	INJ_WAG	ACTIVE
SSAU-4108W	42165018290000	INJ_WAG	ACTIVE
SSAU-4109	42165018300000	PROD_OIL	ACTIVE
SSAU-4110	42165018310000	INJ_WAG	ACTIVE
SSAU-4111	42165018320000	PROD_OIL	ACTIVE
SSAU-4114	42165018330000	INJ_WAG	ACTIVE
SSAU-4116	42165018340000	INJ_WAG	ACTIVE
SSAU-4115	42165018350000	PROD_OIL	ACTIVE
SSAU-4112	42165018360000	INJ_WAG	ACTIVE
SSAU-4113	42165018370000	PROD_OIL	P & A
SSAU-6201	42165018380000	INJ_WAG	ACTIVE
SSAU-6202	42165018390000	PROD_OIL	ACTIVE
SSAU-6203	42165018400000	INJ_WAG	ACTIVE
SSAU-6204	42165018410000	INJ_H2O	ACTIVE
SSAU-6205	42165018420000	PROD_OIL	ACTIVE
SSAU-6206	42165018430000	PROD_OIL	ACTIVE
SSAU-6208	42165018440000	PROD_OIL	P & A
SSAU-6209	42165018450000	INJ_H2O	ACTIVE
SSAU-6210	42165018460000	PROD_OIL	ACTIVE
SSAU-3101	42165018470000	PROD_OIL	ACTIVE
SSAU-3102	42165018480000	INJ_WAG	ACTIVE
SSAU-3103	42165018490000	PROD_OIL	ACTIVE
SSAU-3107	42165018510000	INJ_WAG	P & A
SSAU-3108	42165018520000	PROD_OIL	ACTIVE
SSAU-3109	42165018530000	PROD_OIL	ACTIVE
SSAU-3110	42165018540000	INJ_H2O	ACTIVE
SSAU-3111	42165018550000	PROD_OIL	ACTIVE
SSAU-3106	42165018560000	INJ_WAG	ACTIVE
SSAU-2204	42165018570000	PROD_OIL	ACTIVE
SSAU-2201	42165018580000	INJ_WAG	ACTIVE
SSAU-2203	42165018590000	INJ_WAG	ACTIVE
SSAU-2205	42165018600000	PROD_OIL	P & A
SSAU-2206	42165018610000	PROD_OIL	ACTIVE
SSAU-2208	42165018620000	INJ_WAG	ACTIVE
SSAU-2207	42165018630000	PROD_OIL	INACTIVE
SSAU-2209	42165018640000	PROD_OIL	ACTIVE
SSAU-2210	42165018650000	INJ_WAG	ACTIVE

SSAU-2211	42165018660000	PROD_OIL	ACTIVE
SSAU-3104	42165018730000	INJ_H2O	P & A
SSAU-6207	42165018740000	PROD_OIL	ACTIVE
SSAU-7601	42165018800000	PROD_OIL	ACTIVE
SSAU-7602	42165018810000	PROD_OIL	ACTIVE
SSAU-7603	42165018820000	INJ_H2O	TA
SSAU-7604	42165018830000	PROD_OIL	P & A
SSAU-7001	42165018870000	PROD_OIL	ACTIVE
SSAU-4901	42165020110000	PROD_OIL	ACTIVE
SSAU-4902	42165020120000	PROD_OIL	P & A
SSAU-4903	42165020130000	PROD_OIL	ACTIVE
SSAU-4904	42165020140000	INJ_WAG	ACTIVE
SSAU-4905	42165020150000	PROD_OIL	ACTIVE
SSAU-3201	42165020170000	PROD_OIL	P & A
SSAU-3202	42165020180000	INJ_WAG	INACTIVE
SSAU-3203	42165020190000	PROD_OIL	ACTIVE
SSAU-3204	42165020200000	INJ_WAG	ACTIVE
SSAU-3205	42165020210000	PROD_OIL	TA
SSAU-3206	42165020220000	INJ_WAG	ACTIVE
SSAU-3207	42165020230000	PROD_OIL	ACTIVE
SSAU-3208	42165020240000	INJ_WAG	ACTIVE
SSAU-2301	42165020250000	PROD_OIL	ACTIVE
SSAU-2302	42165020260000	INJ_WAG	ACTIVE
SSAU-2303	42165020270000	PROD_OIL	INACTIVE
SSAU-2304W	42165020280000	INJ_WAG	P & A
SSAU-2305	42165020290000	PROD_OIL	ACTIVE
SSAU-2306	42165020300000	INJ_WAG	ACTIVE
SSAU-2307	42165020310000	PROD_OIL	ACTIVE
SSAU-2308	42165020320000	INJ_WAG	ACTIVE
SSAU-2101	42165020630000	PROD_OIL	ACTIVE
SSAU-1701	42165020650000	PROD_OIL	ACTIVE
SSAU-1702	42165020660000	PROD_OIL	ACTIVE
SSAU-1101	42165020680000	PROD_OIL	ACTIVE
SSAU-1001	42165020690000	PROD_OIL	ACTIVE
SSAU-1002W	42165020700000	INJ_WAG	ACTIVE
SSAU-1003	42165020710000	INJ_WAG	ACTIVE
SSAU-1004	42165020720000	PROD_OIL	ACTIVE
SSAU-1005	42165020730000	PROD_OIL	ACTIVE
SSAU-1006W	42165020740000	INJ_WAG	ACTIVE
SSAU-1007	42165020750000	PROD_OIL	ACTIVE
SSAU-1008	42165020760000	INJ_WAG	ACTIVE

SSAU-1009	42165020770000	PROD_OIL	ACTIVE
SSAU-1010	42165020790000	INJ_WAG	ACTIVE
SSAU-5201A	42165024290000	PROD_OIL	ACTIVE
SSAU-5202	42165024300000	INJ_WAG	ACTIVE
SSAU-5203	42165024310000	PROD_OIL	P & A
SSAU-5204A	42165024330000	INJ_WAG	ACTIVE
SSAU-5401	42165025670000	PROD_OIL	ACTIVE
SSAU-5402	42165025680000	PROD_OIL	ACTIVE
SSAU-5403	42165025690000	INJ_WAG	P & A
SSAU-5404W	42165025700000	INJ_WAG	ACTIVE
SSAU-4201	42165025740000	INJ_WAG	P & A
SSAU-4202	42165025750000	PROD_OIL	TA
SSAU-4203	42165025760000	INJ_WAG	P & A
SSAU-4204	42165025770000	INJ_WAG	ACTIVE
SSAU-7513	42165025950000	PROD_OIL	P & A
SSAU-3105A	42165025990000	PROD_OIL	P & A
SSAU-2602A	42165028350000	INJ_WAG	ACTIVE
SSAU-2502	42165028520000	INJ_WAG	ACTIVE
SSAU-5801	42165032350000	PROD_OIL	TA
SSAU-5702	42165032360000	PROD_OIL	P & A
SSAU-5704	42165032380000	PROD_OIL	TA
SSAU-5705	42165032390000	INJ_H2O	P & A
SSAU-6901	42165032410000	PROD_OIL	P & A
SSAU-7201	42165033030000	PROD_OIL	ACTIVE
SSAU-5001A	42165033170000	INJ_WAG	ACTIVE
SSAU-2214	42165100130000	PROD_OIL	ACTIVE
SSAU-2603	42165100340000	PROD_OIL	ACTIVE
SSAU-4310	42165100700000	PROD_OIL	P & A
SSAU-1508	42165100770000	PROD_OIL	P & A
SSAU-3703	42165101260000	PROD_OIL	P & A
SSAU-3209	42165101610000	PROD_OIL	ACTIVE
SSAU-1906	42165101920000	PROD_OIL	P & A
SSAU-4311	42165101990000	PROD_OIL	ACTIVE
SSAU-4312	42165102000000	PROD_OIL	TA
SSAU-0503	42165102010000	INJ_H2O	P & A
SSAU-3114W	42165106050000	INJ_H2O	P & A
SSAU-3113	42165106300000	PROD_OIL	P & A
SSAU-6211	42165300130000	INJ_H2O	ACTIVE
SSAU-3807	42165300140000	INJ_H2O	P & A
SSAU-3704	42165300150000	INJ_H2O	ACTIVE
SSAU-0403	42165300160000	INJ_H2O	P & A

SSAU-6212	42165300170000	INJ_H2O	ACTIVE
SSAU-7202	42165300180000	INJ_H2O	INACTIVE
SSAU-4907	42165300540000	INJ_H2O	ACTIVE
SSAU-2213	42165300550000	INJ_H2O	TA
SSAU-0303	42165300560000	INJ_H2O	P & A
SSAU-0603	42165300570000	INJ_H2O	ACTIVE
SSAU-4602	42165301250000	INJ_H2O	TA
SSAU-4401	42165301260000	INJ_H2O	ACTIVE
SSAU-2003	42165301270000	INJ_H2O	INACTIVE
SSAU-1907	42165301280000	INJ_H2O	P & A
SSAU-1802	42165301290000	INJ_H2O	TA
SSAU-4802	42165301300000	INJ_H2O	TA
SSAU-8204	42165301310000	INJ_H2O	TA
SSAU-3105R	42165303490000	PROD_OIL	P & A
SSAU-5514R	42165304820000	INJ_WAG	ACTIVE
SSAU-7514	42165304840000	INJ_H2O	ACTIVE
SSAU-1803	42165304850000	INJ_H2O	ACTIVE
SSAU-2915	42165304890000	PROD_OIL	ACTIVE
SSAU-2405	42165305540000	INJ_WAG	ACTIVE
SSAU-3910	42165305550000	PROD_OIL	P & A
SSAU-2406	42165305660000	PROD_OIL	ACTIVE
SSAU-2505	42165305670000	PROD_OIL	TA
SSAU-2504	42165305680000	INJ_WAG	ACTIVE
SSAU-2310	42165311550000	PROD_OIL	ACTIVE
SSAU-4902R	42165311560000	INJ_WAG	ACTIVE
SSAU-2710	42165311570000	INJ_WAG	ACTIVE
SSAU-2810	42165311580000	PROD_OIL	ACTIVE
SSAU-2809	42165311590000	INJ_WAG	ACTIVE
SSAU-2309	42165311600000	PROD_OIL	ACTIVE
SSAU-2312	42165311610000	PROD_OIL	ACTIVE
SSAU-2311	42165311620000	INJ_WAG	ACTIVE
SSAU-2709	42165311760000	PROD_OIL	ACTIVE
SSAU-3119	42165312170000	PROD_OIL	ACTIVE
SSAU-2218	42165312530000	INJ_WAG	ACTIVE
SSAU-2219	42165312540000	PROD_OIL	ACTIVE
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SSAU-4003R	42165337590000	INJ_WAG	ACTIVE
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SSAU-1312	42165341940000	PROD_OIL	ACTIVE
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SSAU-1104	42165342300000	PROD_OIL	ACTIVE
SSAU-901IR	42165342320000	INJ_WAG	ACTIVE
SSAU-3803R	42165346470000	INJ_WAG	ACTIVE
SSAU-0903R	42165346480000	INJ_WAG	ACTIVE
SSAU-2229	42165346490000	PROD_OIL	ACTIVE
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SSAU-2922	42165348760000	PROD_OIL	ACTIVE
SSAU-5505R	42165349450000	PROD_OIL	ACTIVE
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SSAU-3506R	42165361810000	PROD_OIL	ACTIVE
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SSAU-4201R	42165362070000	INJ_WAG	ACTIVE

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SSAU-3123R	42165369440000	PROD_OIL	ACTIVE
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SSAU-3520R	42165377850000	PROD_OIL	ACTIVE
SSAU-4118R	42165378080000	PROD_OIL	ACTIVE
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SSAU-6217	42165380060000	PROD_OIL	ACTIVE
SSAU-6225	42165380140000	PROD_OIL	TA
SSAU-6220	42165380180000	PROD_OIL	ACTIVE
SSAU-6221	42165380230000	PROD_OIL	ACTIVE
SSAU-6223	42165380280000	PROD_OIL	TA
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SSAU-2317R	42165386290000	PROD_OIL	ACTIVE
SSAU-4113R	42165386310000	PROD_OIL	ACTIVE
SSAU-2505R	42165386320000	PROD_OIL	ACTIVE
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SSAU-3107R	42165386730000	INJ_WAG	ACTIVE
SSAU-3703R	42165386740000	PROD_OIL	ACTIVE
SSAU-4021S	42165386760000	PROD_OIL	ACTIVE

12.2 Regulatory References
Regulations cited in this plan:

1. 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

2. Oil and Gas Procedure Manual:
https://www.rrc.texas.gov/oil-and-gas/publications-and-notices/manuals/oil-and-gas-procedure-manual/

Appendix B: Submissions and Responses to Requests for Additional Information

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

July 2023

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1. Introduction

OXY USA INC, a subsidiary of Occidental (Oxy) operates a CO_2-Enhanced Oil Recovery (CO_2-EOR) project in the Seminole San Andres Unit (SSAU). This Monitoring, Reporting, and Verification (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 CO_2 sequestered at the SSAU during a specified period of injection.

2. Facility Information

2.1 Reporter Number

XXXX –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 in-service wells in the SSAU (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 SSAU are currently classified as UIC Class II wells.

2.3 Existing Wells

Wells in the SSAU are identified by name and number, API number, type, and status. The list of wells as of November 2022 is included in Section 12.1. Any changes in these wells or additional wells will be indicated in the annual monitoring report.

3. Project Description

This project takes place in the SSAU, an oilfield located in West Texas that was first produced in 1941. CO_2 flooding was initiated in 1983 and the injection plan calls for an additional total of approximately 174 million metric tons of CO_2 to be stored over the remaining lifetime of the project. The field is well characterized and Oxy determined that it 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 1.0 or very close to it. Oxy constructed a history-matched reservoir simulation of the injection at SSAU.

3.1 Project Characteristics

The Seminole San Andres field was discovered in 1936 and started producing in 1941. The field was unitized in 1968, and waterflood was initiated in 1969. CO_2 flooding was initiated in 1983. A long-term forecast for SSAU was developed using the reservoir modeling approaches described in Section 3.4, including storage of an additional total of approximately 174 million metric tons of CO_2 over the remaining life of the project. Figure 1 shown below, is a graph of the quantity of CO_2 injected, produced, and stored between 1983 and 2021 (solid lines) and a forecast of the CO_2 that will be injected, produced, and stored between 2022 and 2055 (dashed lines) in the SSAU. Oxy has injected 224 million metric tons (MMT) of CO_2 into the SSAU through the end of 2021. Of

that amount, 109 MMT CO_2 was produced and reinjected, and 115 MMT CO_2 was stored. Oxy forecasts CO_2 injection of 532 MMT from the year 2022 until the year 2055, which is currently projected to be the end of the project. Of that amount, 358 MMT is forecast to be produced and 174 MMT will be stored.

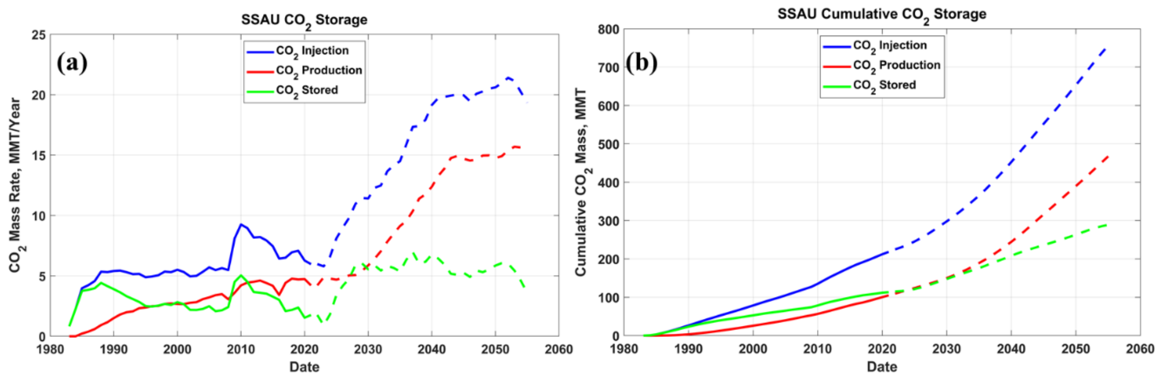

Figure 1—SSAU Historic and Forecast CO_2 Injection, Production, and Storage (a) Rate (MMT/Year), (b) Cumulative Mass (MMT)

3.2 Environmental Setting

The SSAU is located in the northeast portion of the Central Basin Platform in West Texas (Figure 2).

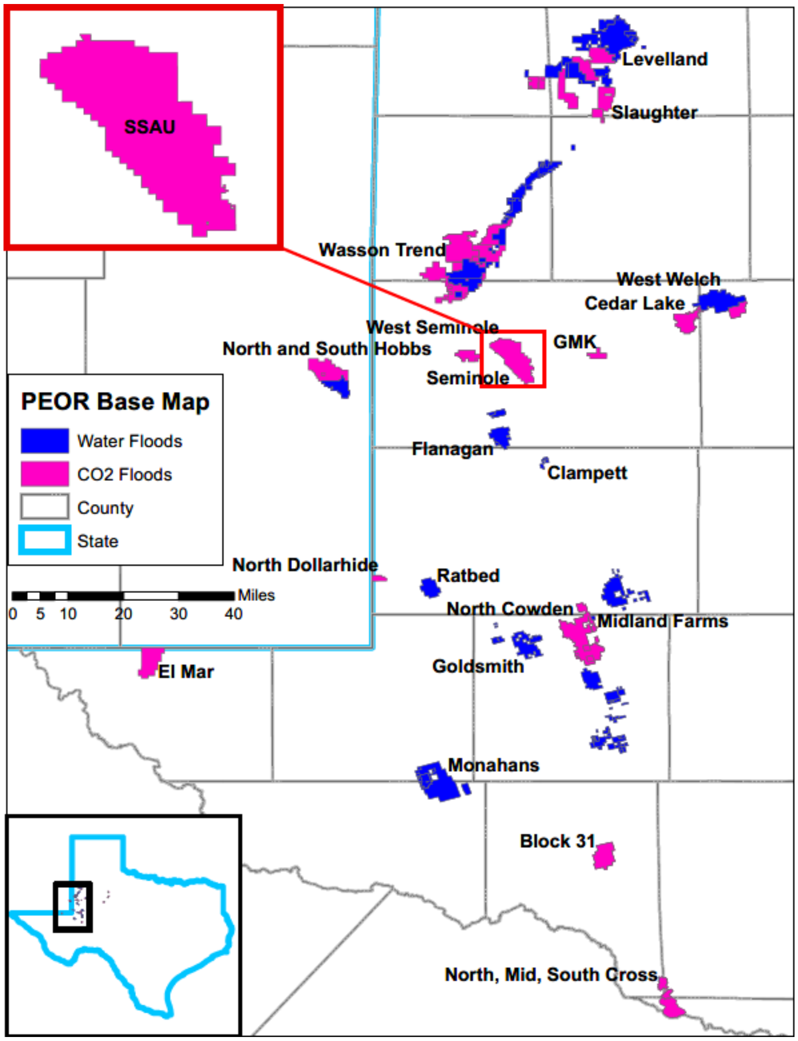

Figure 2—Location of SSAU in West Texas

Figure 3 is a schematic of the SSAU storage complex. The SSAU sequestration zone ranges between 1,165 and 1,850 ft in thickness with an average thickness of 1,600 ft. This productive interval, or reservoir, is within the San Andres Formation and 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.

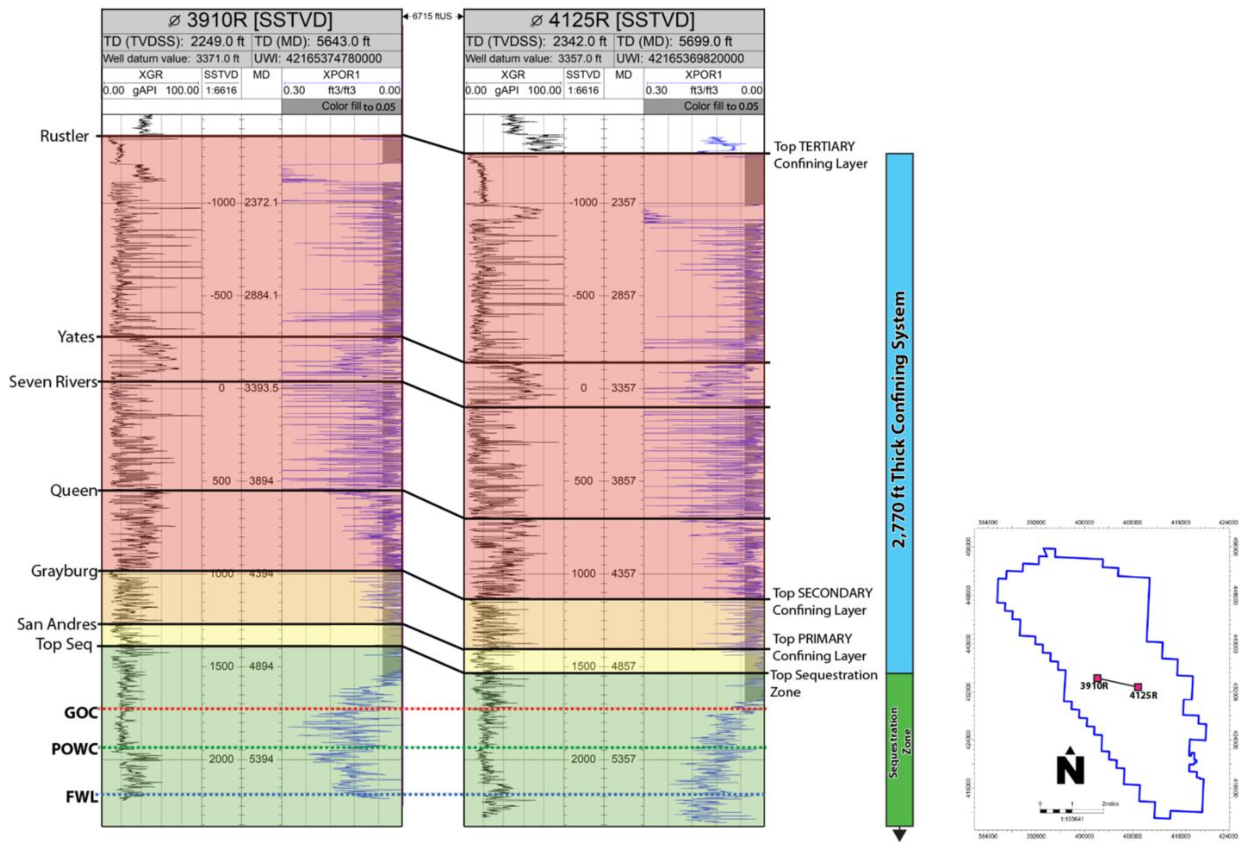

Figure 3—SSAU Geologic Column. Notes: TD = Total Depth, TVDSS or SSTVD = Total Vertical Depth Subsea, MD = Measured Depth, UWI = Unique Well Identification number, XGR = Gamma Ray log, XPOR1 = Porosity log, GOC = Gas Oil Contact, POWC = Producing Oil Water Contact, FWL = Free Water Level.

Figure 3 shows the overlying confining system, which consists of non-porous anhydritic strata that are ~2,770 ft thick and are comprised of three sub-zones:

- A ~95 ft thick primary confining layer between the top of sequestration zone and top of San Andres Formation;
- A ~200 ft thick secondary confining layer between San Andres Formation and Grayburg Formation; and,
- A ~2,350 ft thick tertiary confining layer from the Grayburg Formation to the Rustler Formation.

There are numerous relatively thin layers that provide additional secondary containment between the sequestration zone and freshwater aquifers found at a depth of 250 feet. These layers are comprised of siltstones, shales, salts, and anhydrite sequences with little to no porosity or permeability.

SSAU is located in the Permian Basin on the northeast portion of the Central Basin Platform in West Texas. SSAU is draped over a fault-bounded doubly plunging anticline that tips out in Devonian strata where several N-NW trending seismically resolvable faults have been identified and mapped. Faults are situated southwest of the structural crest, with a maximum offset of 1,800 ft within Devonian strata and tip out approximately 1,700 ft below the SSAU sequestration zone. Oxy extensively analyzed seismic data acquired over the SSAU to assess potential leakage pathways and basement-rooted faults. Oxy determined that seismic attributes, such as coherence, do not reveal linear discontinuities beyond those currently mapped. Likewise, Oxy found that downhole measurements from profile logs and micro-resistivity imaging tools show no indication of conductive faults or fractures. Pressure-based interference tests and simulation-based history matching also indicate that reservoir behavior has not been modified by faults and fractures. In summary, Oxy determined that multiple fault/fracture characterization tools indicate the sequestration zone and confining system are free of faults and fractures that could act as leakage pathways.

SSAU is a dome structure that includes the highest elevations within the area. The elevated area forms a natural trap for oil and gas that migrated upward from deeper source rocks over millions of years. Once trapped in these higher elevations, the oil and gas remained in place. In the case of SSAU, this oil and gas has been trapped in the reservoir for 50 to 100 million years. Over time, buoyant fluids, including CO_2, rose vertically until reaching the highest elevation of the structure. Figure 4 shows the Top San Andres pay interval structure. The colors in the structure map in Figure 4 indicate the subsurface elevation, with red illustrating a higher or shallower level and dark blue illustrating a lower or deeper level.

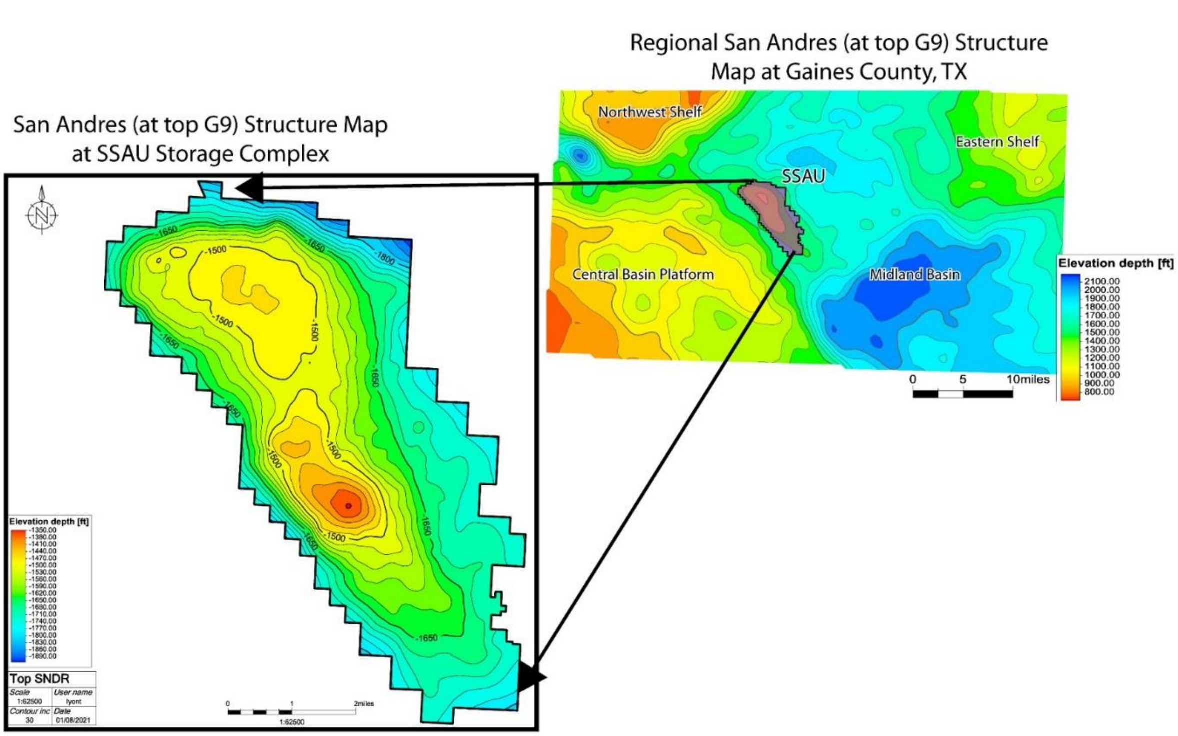

Figure 4—Local Area Structure on Top of San Andres. Note: Top SNDR = Top San Andres

Because of buoyancy differences between oil, water and gas phases, the gas column at SSAU sits above the oil. Water, being the least buoyant of the three fluid phases, is found below the oil. At the time of its discovery, natural gas was trapped at the structural high points of SSAU, 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 Formation. Gas is buoyant and highly mobile. If it could escape SSAU naturally, through faults or fractures, it would have done so over the millennia. Below the gas cap is an oil accumulation called the oil zone. There are no distillable hydrocarbons below the oil zone.

Once the CO_2 flood is complete and injection ceases, the remaining mobile CO_2 will rise slowly upward, driven by buoyancy forces and will be trapped by the confining system. There is more than enough pore space to sequester the planned CO_2 injection. The amount of CO_2 injected will not exceed the reservoir's secure storage capacity; consequently, there is negligible risk that CO_2 could migrate to other reservoirs in the Central Basin Platform. The total reservoir pore volume is calculated to be 5,816 million reservoir barrels (MMRB) from the top of the reservoir down to the base of the oil zone. This equals the volume of rock multiplied by porosity. Table 1 shows the conversion of this amount of pore space into an estimated maximum mass of CO_2 storage of approximately 509 MMT. The total stored CO_2 from previous EOR and the planned forecast injection will fill approximately 57% of the total calculated storage capacity.

Table 1—Calculation of Maximum CO_2 Storage Capacity (MMT) at SSAU

Top of Pay to Free Water Level (2,175 ft subsea)	
Variables	SSAU Outline
Pore Volume (MMRB)	5,816
B_{CO2}	0.41
S_{wirr}	0.18
S_{orCO2} (volume weighted)	0.14
Max CO_2 Billion Cubic Feet (Bcf)	9,646
Max CO_2 (MMT)	509

$$\text{Max } CO_2 = \text{Pore Volume (RB)} * (1 - S_{wirr} - S_{orCO2}) / B_{CO2}$$

Where:

Max CO_2 = maximum CO_2 storage capacity, MMT
Pore Volume (RB) = volume of the rock formation in Reservoir Barrels
B_{CO2} = formation volume factor for CO_2
S_{wirr} = irreducible water saturation
S_{orCO2} = irreducible oil saturation

Oxy has a high degree of confidence that stored CO_2 will be contained securely within the reservoir because: 1) SSAU is located at the highest subsurface elevations in the area; 2) the confining zone has proved competent over millions of years and with current CO_2 flooding; and, 3) SSAU has ample storage capacity.

3.3 Description of CO_2-EOR Project Facilities and the Injection Process

Figure 5 shows a simplified process flow diagram (PFD) of the project facilities and equipment in the SSAU. CO_2 is delivered to SSAU via the Permian Basin CO_2 pipeline network from several different sources.

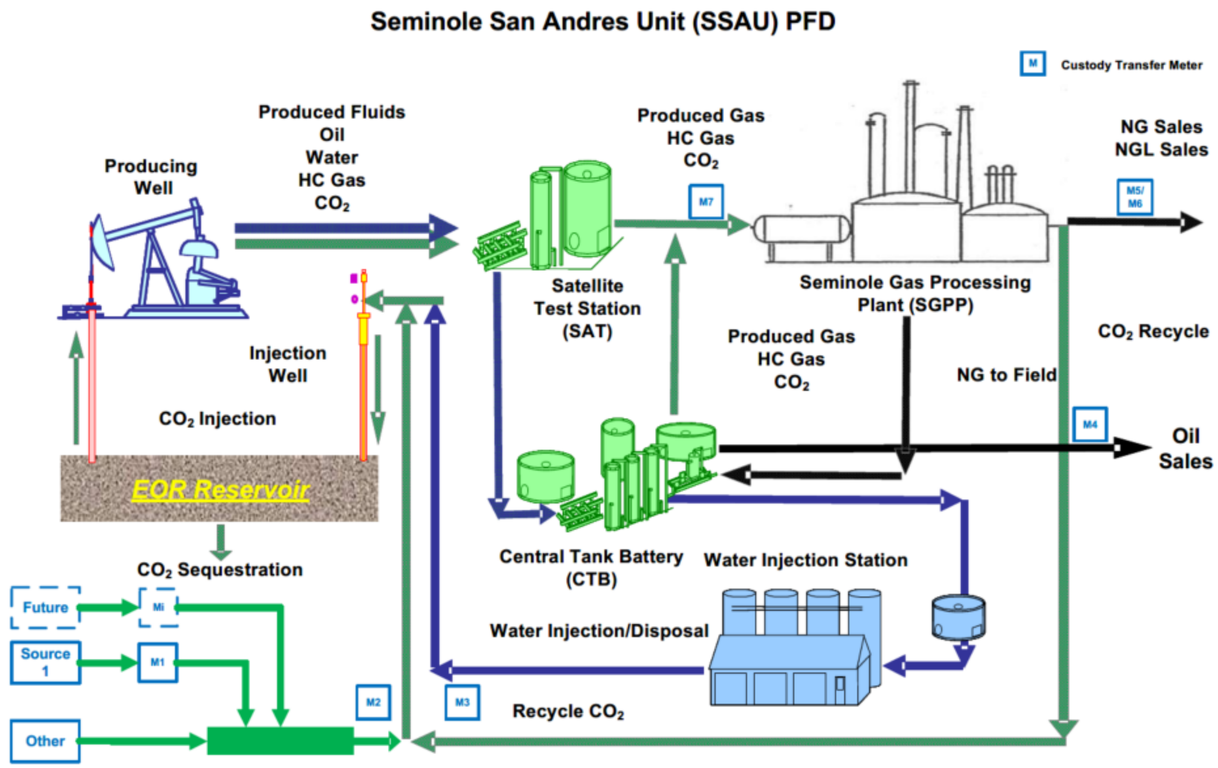

Figure 5—SSAU Process Flow Diagram. Notes: HC = Hydrocarbon, NG = Natural Gas, NGL = Natural Gas Liquids

Once CO_2 enters SSAU, there are three main processes involved in EOR operations:

1. **CO_2 Distribution and Injection.** The mass of CO_2 received at SSAU is metered and calculated through the custody transfer meter located at the pipeline delivery point, as indicated by the box labeled "M2" in the bottom left of Figure 5. The mass of CO_2 received is combined with recycled CO_2 from the Seminole Gas Processing Plant (SGPP), denoted by box labeled "M3," and distributed to the CO_2 trunklines for injection into the injection wells according to the pre-programmed injection plan for each well pattern, which alternates between water and CO_2 injection. This is an EOR project, and reservoir pressure must be maintained above the minimum miscibility pressure (MMP). Therefore, injection pressure is maintained at a level that is sufficiently high to allow injectants to enter the reservoir, but below the formation parting pressure (FPP).

2. **Produced Fluids Handling.** Produced fluids from the production wells are a mixture of oil, hydrocarbon gas, water, CO_2, and trace amounts of other constituents in the field including nitrogen and hydrogen. Fluids are gathered from producer wells and sent to

satellite test stations (SAT) for separation into a gas/CO_2 mix and a produced fluids mix of water, oil, gas, and CO_2. The gas/CO_2 mix, which is composed primarily of hydrocarbons and CO_2, is sent to the SGPP for CO_2 separation, dehydration, sweetening, and compression before reinjection into the reservoir. The mix of water, oil, gas, and CO_2 is sent to the central tank battery (CTB) where water is separated for reinjection or disposal; oil is separated for sale and metered through a custody transfer meter, and then moved into the pipeline; and, the remaining gas/CO_2 mix is combined with gas/CO_2 separated from the produced fluids in the SAT. The total amount of CO_2 produced is measured using meters labeled "M4" and "M3" on Figure 5.

3. **Water Treatment and Injection.** Water is recovered from the CTB for reuse and forwarded to the water injection station for treatment and reinjection using a closed loop process or for disposal.

3.3.1 Wells in the SSAU

The 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 Oil and Gas Procedure Manual (see Appendix 12.2). 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 underground sources of drinking water 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 where they are encountered into other strata, or into subsurface and surface waters;
- A completion report for each well that includes an electric log (e.g., a density, sonic, or resistivity) 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 and the location and setting of plugs; and,
- Injection well operators must identify an Area of Review (AoR), use materials and equipment compatible with the injection fluids, test, and maintain well records.

Table 2 provides a well count by type and status as of November 2022. All these wells are in material compliance with TRRC rules.

Table 2—SSAU Well Penetrations by Type and Status (as November 2022)

Row Labels	ACTIVE	INACTIVE	P&A	SHUT-IN	TA	Grand Total
INJ_H2O	27	4	16	0	10	57
INJ_WAG	190	3	11	4	2	210
PROD_OIL	306	21	60	0	30	417
Grand Total	**523**	**28**	**87**	**4**	**42**	**684**

Notes: INJ_H2O = water injector, INJ_WAG = Water Alternating Gas Injector, PROD_OIL = Oil producer, P&A = Plugged and Abandoned, TA = Temporarily Abandoned

As indicated in Figure 6, wells are distributed across the SSAU. The well patterns currently undergoing CO_2 flooding are outlined in the black box. During the life of the project the well count and status is projected to change as the SSAU injection plan is implemented. Oxy may seek TRRC approval to drill new wells, recomplete existing wells, or plug and abandon existing wells. Such changes will be included in the annual monitoring report.

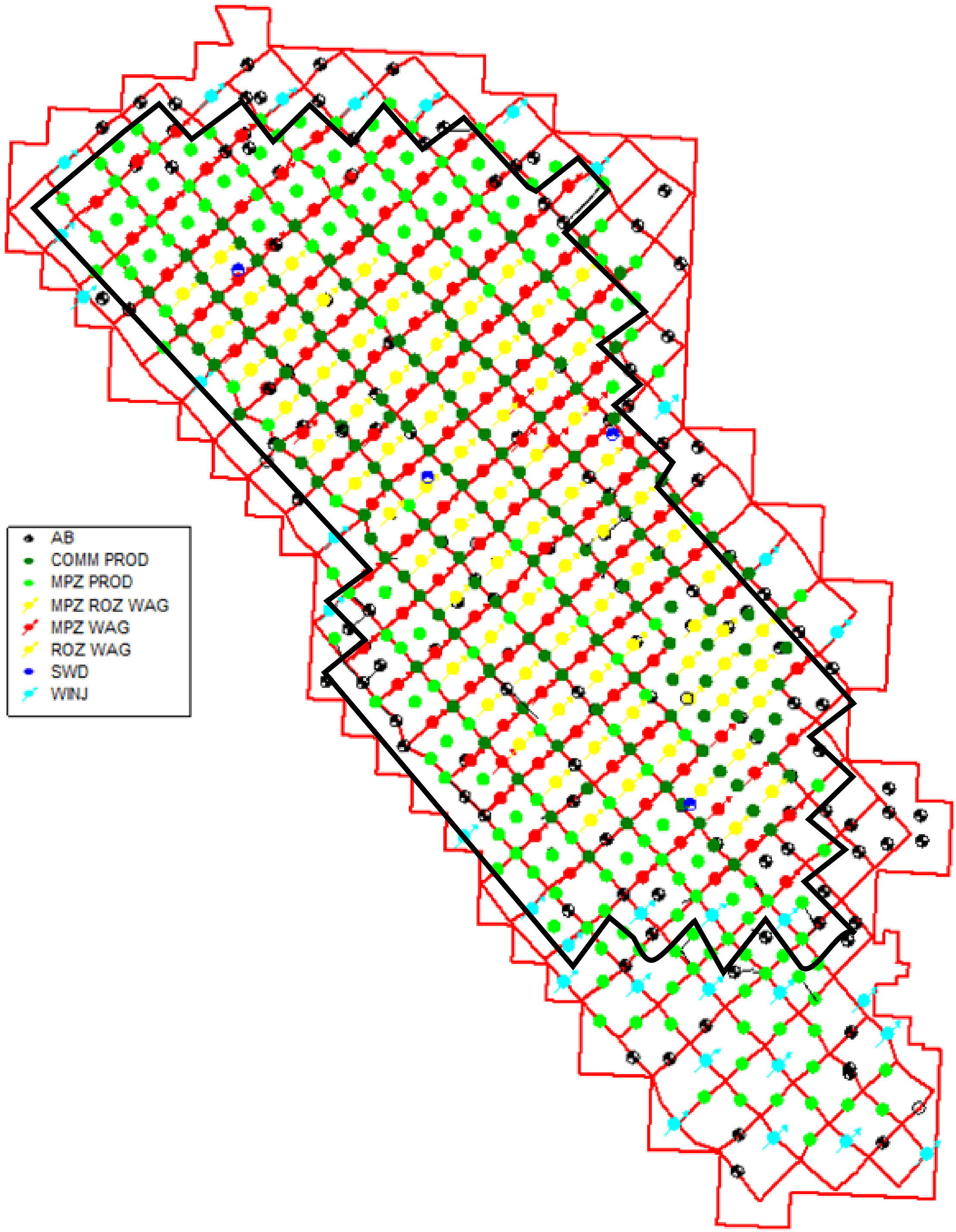

Figure 6—SSAU Wells and Injection Patterns. Notes: AB = Abandoned, COMM PROD = Commingled Producer, MPZ PROD = Main Pay Zone Producer, MPZ ROZ WAG = Main Pay Zone Residual Oil Zone Water Alternating Gas, MPZ WAG = Main Pay Zone Water Alternating Gas, ROZ WAG = Residual Oil Zone Water Alternating Gas, SWD = Saltwater Disposal, WINJ = Water Injector

SSAU CO_2 EOR operations are designed to avoid conditions that could damage the reservoir and create a potential leakage pathway. Oxy manages reservoir pressure by maintaining an injection-to-withdrawal ratio (IWR)[1] of approximately 1.0. To do this, 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 oilfield.

Oxy maintains injection pressure below the FPP, which is measured using step-rate tests.

3.4 Reservoir Modeling

A history-matched reservoir model of the current and forecast SSAU CO_2 injection plan has been constructed using tNavigator, which is a commercially available reservoir simulation software program. The model simulates the recovery mechanism in which CO_2 is miscible with the hydrocarbon phase in the reservoir.

The model was created to:

- Demonstrate that the storage complex has, at the minimum, the capacity to contain the planned mass of injected CO_2; and
- Track injected CO_2, identify how and where CO_2 is trapped in the SSAU, and monitor sequestration mass and distribution.

The reservoir model utilizes four types of data:

1. Site Characteristics as described in the SSAU geomodel,
2. Initial reservoir conditions and fluid property data,
3. Capillary pressure data, and
4. Well data.

The static geomodel that serves as the foundation for the dynamic simulation model used data from digital open- and cased-hole logs of 684 wells within the SSAU boundary to correlate formation tops. Oxy developed a sequence stratigraphic framework for SSAU based on core descriptions and outcrop analogs. Oxy selected the sequence stratigraphic correlations of flow units at the base of mud-dominated flooding surfaces in core, linked to well logs, and extrapolated throughout the field.

The dynamic simulation model is a four-component model consisting of water, oil, reservoir gas, and injected CO_2. It is an extension of the black oil model that enables the modeling of various recovery mechanisms, including miscible injection of CO_2, which is justified because the reservoir under study is above MMP. Oxy used the total hydrocarbon and solvent (CO_2) saturation to calculate relative permeability to water. Oxy then used the solvent and oil relative permeability to

[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.

calculate multipliers from a look-up table. Oxy used the Todd-Longstaff[2] model to calculate the effective viscosity and density of the hydrocarbon and solvent phases.

Oxy conducted history matching on the dynamic simulation model to adjust input parameters within the range of data uncertainties until the actual reservoir performance was closely reproduced in the model. Using this process, Oxy obtained an 84-year history match. 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 four graphs in Figure 7 present the history match results of oil rate, water rate, liquid rate, and gas rate, showing that the reservoir model provides an excellent match to actual historical data. Figure 8 shows the matches of water and CO_2 injection.

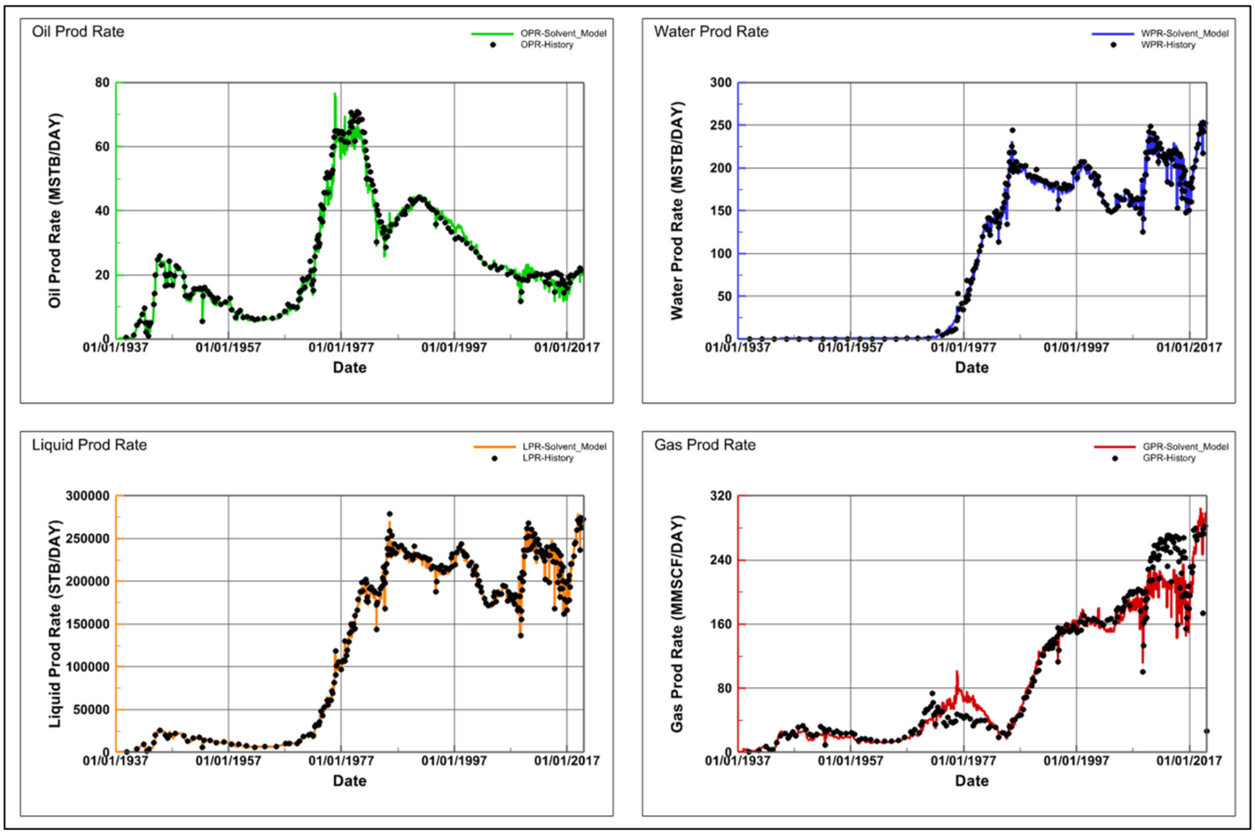

Figure 7—Four Parameters of History-Matched Modeling in the SSAU Reservoir Model. Notes: OPR = Oil Production Rate; WPR = Water Production Rate; MSTB/Day = Thousand Stock Tank Barrels per Day, MMSCF/Day = Million Standard Cubic Feet per Day

[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).

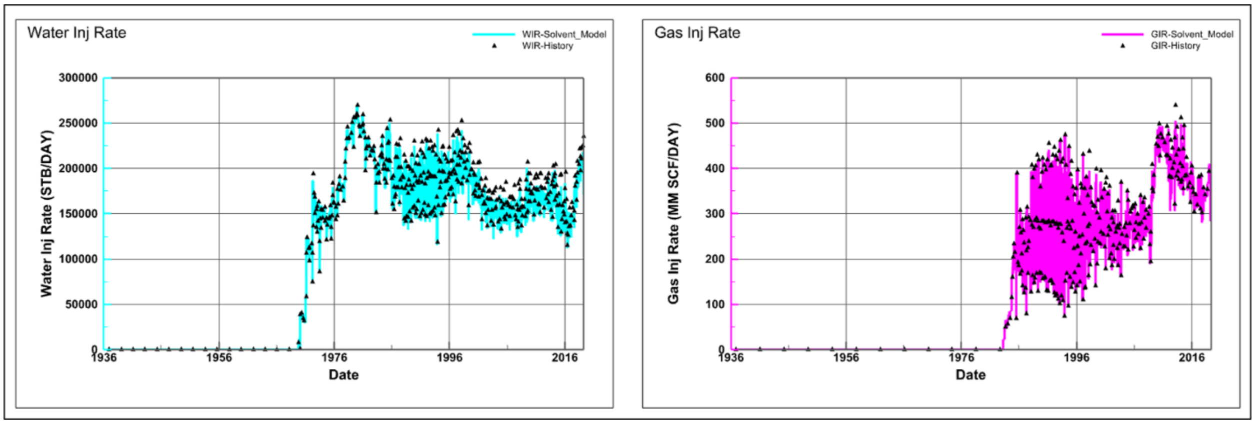

Figure 8—Plots of Injection History Match in the SSAU Reservoir Model. Note: WIR = Water Injection Rate; GIR = Gas Injection Rate

Oxy used the SSAU reservoir model to evaluate the plume of CO_2 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's CO_2 storage performance. The model forecast showed that CO_2 is contained in the reservoir within the boundaries of SSAU.

4. Delineation of Monitoring Area and Timeframes

4.1 Active Monitoring Area

The Active Monitoring Area (AMA) is shown in Figure 9. It is the SSAU plus the required ½-mile buffer. 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).

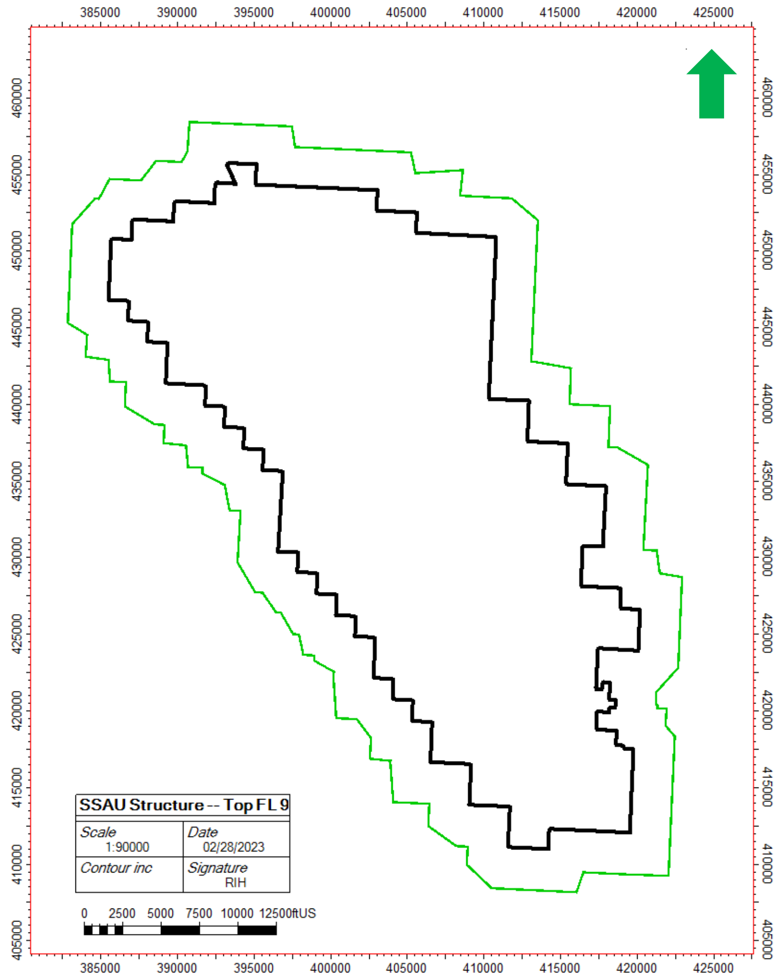

Figure 9—SSAU Unit Boundary with the ½ mile buffer boundary (green)

The AMA determination is supported by project design and site geology as follows:

- Oxy operates injector and producer wells throughout the SSAU as indicated in Figure 6.
- CO_2 injected into the SSAU remains contained within the SSAU because of Oxy's fluid and pressure management practices, i.e., the maintained IWR of 1.0 is consistent with stable reservoir pressure. Managed lease line injection and production wells are used to retain fluids, and operational results confirm that the injected CO_2 is retained within the SSAU.
- The SSAU is a structural high within the formation, therefore CO_2 will migrate updip within the SSAU to the structurally highest position and be retained by the geologic confining unit. CO_2 will not migrate downdip.

4.2 Maximum Monitoring Area

The Maximum Monitoring Area (MMA) is the SSAU plus the required ½-mile buffer (see Figure 9). The maximum extent of CO_2 after the CO_2 plume has stabilized will be contained within the SSAU, therefore the boundary of SSAU plus ½ mile buffer is consistent with the definition in 40 CFR 98.449. After operations cease, the CO_2 plume is projected to remain within the SSAU due to the factors described in Section 3.2 (presence of a structural trap, competent confining zone that has sealed for millions of years, and sufficient pore space), and use of IWR of approximately 1.0. The reservoir model shows that by the end of CO_2 injection, average reservoir pressure will be approximately 2,790 psi. Once injection ceases, reservoir pressure is predicted to stabilize within one year. Over time, reservoir pressure is expected to decline 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.

4.3 Monitoring Timeframes

The primary purpose for injecting CO_2 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 CO_2 in the SSAU. The specified period will be shorter than the period of production from the SSAU.

At the conclusion of the specified period, a request for discontinuation of reporting will be submitted with a demonstration that current monitoring and model(s) show that the cumulative mass of CO_2 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 SSAU is collected for use in reservoir modeling and operations management. Reservoir pressure is not forecast to change appreciably because the IWR will be maintained at approximately 1.0. The reservoir model shows that by the end of CO_2 injection, average reservoir pressure will be approximately 2,790 psi. Once injection ceases, reservoir pressure is predicted to stabilize within one year. Over time, reservoir pressure is expected to decline 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.

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

In the 84 years since the SSAU oilfield 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 CO_2 to the surface, including:

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

1. Existing Wellbores,
2. Faults and Fractures,
3. Natural and Induced Seismic Activity,
4. Previous Operations,
5. Pipeline/Surface Equipment,
6. Lateral Migration Outside the SSAU,
7. Drilling Through the CO_2 Area, and
8. 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 CO_2 flooding, an extensive review of all SSAU penetrations was completed to determine the need for any corrective action. That analysis showed that all penetrations have either been adequately plugged and abandoned or, if still in use, do not require corrective action. All wells Oxy constructed and operates in the SSAU are in compliance with TRRC rules.

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

- CO_2 flood beam-pumped wells,
- Electrical submersible pump (ESP) producer wells,
- Naturally flowing producer wells,
- Hydraulic jet pump producer wells,
- CO_2 WAG injector wells, and
- Water injectors.

A risk assessment undertaken for SSAU classified all risks associated with the subsurface as low risk, i.e., less than 1% likelihood to occur and having a consequence that is insubstantial, which is less than 1% of injected volume during the duration of the event. The risks were classified as low risk because the SSAU geology is well suited to CO_2 sequestration with an extensive confining zone that is free of fractures and faults that could be potential conduits for CO_2 migration. The low risk is supported by the results of the reservoir model, which shows that stored CO_2 is not predicted to leave the SSAU boundary. Any risks are further mitigated because the SSAU is operated in a manner that maintains, monitors, and documents the integrity of the reservoir.

The risk of well leakage is mitigated through:

- Adhering to regulatory requirements for well drilling and testing;
- Implementing best practices Oxy has developed through its extensive operating experience;
- Monitoring injection and production performance, wellbores, and the surface; and,

- Maintaining surface and subsurface equipment.

Continual and routine monitoring of the wellbores and site operations will be used to detect leaks or other potential well problems, as follows, and as discussed in Section 6.1.5 below:

- Pressure in injection wells is monitored on a continual basis. The injection plans for each pattern are programmed into the injection WAG skids to govern the rate, pressure, and duration of either water or CO_2 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 an 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 CO_2 EOR projects, is that such leakage is very rare, and there have been no incidents of fluid migration out of the intended zone at SSAU.
- Production well performance is monitored using the production well tests, when produced fluids are gathered and sent to a 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 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 CO_2 flooding efficiency is optimized. Production well performance that does not meet planned performance is investigated and any identified issues are addressed. Leakage to the outside of production wells is not considered a major risk because reduced pressure in the casing will prevent leakage outside the wellbore. Further, the personal H_2S monitors are designed to detect the presence of leaked fluids around production wells during well inspections.
- Field inspections are conducted on a routine basis by field personnel. CO_2 leaking through an orifice is cold and leads to formation of bright white clouds and ice that are easily spotted. All field personnel are trained to identify leaking CO_2 and other potential problems at wellbores and in the field. Any CO_2 Surface Leakage detected will be documented and reported and quantified.

Based on ongoing monitoring activities and review of the potential leakage risks posed by wellbores, Oxy concludes that the risk of CO_2 Surface Leakage through wellbores is being mitigated by continuous monitoring and by promptly responding to any detected problems as they arise. Any mass of CO_2 Surface Leakage that occurs will be quantified.

5.2 Faults and Fractures

After reviewing geologic and seismic data, Oxy concluded that there are no known faults or fractures that transect the San Andres Formation in the project area. As a result, there is no risk of CO_2 Surface Leakage due to known fractures or faults.

Oxy manages injections patterns to ensure that the injection pressure does not exceed formation parting pressure (FPP) and does not induce faults of fractures. Oxy routinely measures and updates

FPP and reservoir pressure. Oxy also maintains an IWR at or near 1.0. These practices mitigate the potential for CO_2 injection to induce faults or fractures. As a safeguard, WAG skids are continuously monitored and equipped with automatic shutoff controls should injection pressures exceed programmed settings.

5.3 Natural or Induced Seismicity

After reviewing the literature and actual operating experience, Oxy concluded that there is no direct evidence that natural seismic activity poses a significant risk for loss of CO_2 to the surface in the Permian Basin, specifically in the SSAU.

To evaluate the potential seismic risk at SSAU, Oxy 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 seismic events are judged to be from natural causes. Others are near oilfields or water disposal wells and are placed in the category of "quakes in close association with human enterprise."[4] In December 2022, Oxy reviewed the United States Geological Survey (USGS) database of recorded earthquakes at M3.0 or greater in the Permian Basin and found that none have occurred at or near the SSAU. The nearest recorded earthquake occurred in 1992 and was located approximately 30 miles away. Oxy also participates in the TexNet seismic monitoring network[5] and will continue to monitor for seismic signals that could indicate the creation of potential leakage pathways in SSAU.

The absence of any M3.0 or greater seismic events at or near SSAU indicates that Oxy's injection operations at SSAU do not induce seismicity. Also, natural seismicity is not significant in the area. Therefore, Oxy concludes there is no likely seismicity pathway for CO_2 Surface Leakage.

In addition, Oxy is not aware of any reported loss of injectant (brine water or CO_2) to the surface above SSAU associated with any seismic activity. If induced seismicity resulted in a pathway for material amounts of CO_2 to migrate from the injection zone, Oxy's other reservoir fluid monitoring provisions (e.g., reservoir pressure, well pressure, and pattern monitoring) would detect the migration and lead to further investigation.

5.4 Previous Operations

CO_2 flooding was initiated in SSAU in 1983. To obtain permits for CO_2 flooding, the AoR around all CO_2 injector wells was evaluated for the presence of any known and unknown penetrations and to assess if corrective actions were required. As indicated in Section 5.1, this evaluation reviewed the identified penetrations and determined that no additional corrective actions were 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. Throughout its CO_2 EOR operations, Oxy's constructs wells with materials that are designed to be compatible with CO_2 injection. These practices ensure that there are no unknown penetrations within SSAU and that the risk of a release from legacy wells has been evaluated (as already indicated, no

[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

corrective actions were required). Oxy's continuous monitoring program, described above in section 5.1, further mitigates the risk of a CO_2 Surface Leakage from the identified penetrations. The successful experience with CO_2 flooding in SSAU demonstrates that the confining zone has not been impaired by previous operations.

5.5 Pipelines and Surface Equipment

As part of routine risk management described in Section 5.1, the potential risk of Surface Leakage associated with the following were identified and evaluated:

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

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

The risk of pipeline and surface equipment leakage is mitigated through:

- Adhering to regulatory requirements for well drilling and testing;
- Implementing best practices Oxy has developed through its extensive operating experience;
- Monitoring injection and production performance, wellbores, and the surface; and,
- Maintaining subsurface and surface equipment.

Personnel continuously monitor the pipeline using the Supervisory Control and Data Acquisition (SCADA) system and can 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 CO_2 EOR projects in the oil and gas industry. Operating and maintenance practices currently follow and will continue to follow demonstrated industry standards. CO_2 delivery via the Permian Basin CO_2 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 Surface Leakage be detected from pipeline or surface equipment, the mass of CO_2 Surface Leakage will be quantified following the requirements of Subpart W of EPA's Greenhouse Gas Reporting Program (GHGRP).

5.6 Lateral Migration Outside the SSAU

It is highly unlikely that injected CO_2 will migrate downdip and laterally outside the SSAU because of the nature of the geology and the approach Oxy uses for injection. The SSAU boundary contains a local structural high of the San Andres formation, as well as overlying and underlying formations. As injected CO_2 will rise vertically upward over long periods of time, the SSAU structure forms a

trap configuration that funnels the injected CO_2 towards the crest of the structure, thereby preventing lateral migration beyond the unit boundary. In addition, the planned injection mass and active fluid management during injection operations will prevent CO_2 from migrating laterally out of the structure. Finally, the total mass of fluids contained in the SSAU will stay relatively constant. Based on site characterization and planned and projected operations, it is estimated that the total mass of stored CO_2 will be considerably less than the calculated storage capacity.

5.7 Drilling in the SSAU

The TRRC regulates well drilling activity in Texas. Pursuant to TRRC rules, well casing shall be securely anchored in the hole to control the well effectively at all times, all usable-quality water zones shall be isolated and sealed off effectively to 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 re-entered. Well drilling activity at SSAU is conducted in accordance with TRRC rules. Oxy’s visual inspection process, including routine site visits, will identify any unapproved drilling activity in the SSAU.

In addition, Oxy intends to operate SSAU 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 CO_2. Consequently, the risks associated with third parties penetrating the SSAU 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 ensures 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 investigations as to the cause.

5.9 Leakage Detection, Verification, and Quantification

Oxy monitors the potential sources of CO_2 Surface Leakage. Table 3 summarizes the range of identified potential scenarios that could result in CO_2 Surface Leakage, the monitoring activities designed to detect such leakage, and Oxy’s standard response.

Table 3—Response Plan for CO_2 Emitted from Surface Leakage

Risk	Monitoring Plan	Response Plan
Tubing Leak	Monitor changes in tubing and annulus pressure; Mechanical Integrity Testing (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 bottomhole pressure control	Blowout during well operations	Expeditiously conduct well kill procedures
Unplanned wells drilled through San Andres	Routine field inspection to prevent unapproved drilling; compliance with TRRC permitting for planned wells	Ensure compliance with TRRC regulations
Loss of seal in abandoned wells	Reservoir pressure in WAG Skids; 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 Skids; high pressure found in new wells	Fluid management along lease lines
Leakage through induced fractures	Reservoir pressure in WAG Skids; high pressure found in new wells	Comply with rules for keeping injection pressures below parting pressure
Leakage due to seismic event	Reservoir pressure in WAG Skids; high pressure found in new wells	Shut in injectors near seismic event, assess reservoir and take corrective action as needed

Given the uncertainty concerning the nature and characteristics of any leaks that may be encountered, Oxy will determine the most appropriate method to quantify the volume of CO_2 using an event-driven process 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. The potential quantification methods may include, but are not limited to:

- For leakage through wellbores, continuous SCADA monitoring data provide the basis to determine duration and the amount of CO_2 loss;
- For leakage from surface equipment and pipelines, continuous SCADA monitoring data and acceptable emission factors, such as those in 40 CFR Part §98 Subpart W, provide the basis to determine duration and the amount of CO_2 loss;
- For leakage related to the competency of the confining layer, reservoir modeling and engineering estimates provide the basis for determining the amount of CO_2 loss.

CO_2 Surface Leakage will be documented, evaluated, and addressed in a timely manner. Records of CO_2 Surface Leakage 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.

5.10 Summary

The structure and stratigraphy of the San Andres reservoir in the SSAU is ideally suited for the injection and storage of CO_2. The stratigraphy within the CO_2 injection zones is porous, permeable, and thick, providing ample capacity for long-term CO_2 storage. The reservoir is overlain by several intervals of impermeable geologic zones that form effective seals for fluids in the reservoir. After assessing the potential risk of release from the subsurface and mitigating the risk of leakage from wellbores, it has been determined that the potential threat of CO_2 Surface Leakage is extremely low.

In summary, based on a careful assessment of the potential risk of release of CO_2 from the subsurface, it has been determined that there are no leakage pathways at the SSAU that are likely to result in CO_2 Surface Leakage. Further, given the detailed knowledge of the field and its operating protocols, it is concluded that in the unlikely event CO_2 leakage to the surface occurs, either through identified or unexpected leakage pathways, it would be detected quickly, quantified, and addressed promptly.

6. Monitoring and Considerations for Calculating Site-Specific Variables

Monitoring will be used to determine the quantities in the mass balance equations and to make the demonstration that the CO_2 plume will not migrate to the surface after CO_2 injection is discontinued.

The first part of this section describes how site-specific monitoring will be used to quantify the variables used in the mass balance equations discussed in Section 8 below. The second part of this section describes the monitoring program in place to collect data for the demonstration that the CO_2 plume will not migrate to the surface and support the request to discontinue monitoring described in Sections 4.3 and 9.

6.1 Variables for the Mass Balance Equation

6.1.1 General Monitoring Procedures

Flow rate, pressure, and CO_2 gas composition data are monitored and collected from the SSAU 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 SSAU follow the prevailing industry standard(s) for custody transfer as currently promulgated by the American Petroleum Institute (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 and calibrated 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 CO_2 Received

Oxy measures the volumetric rate of received CO_2 using a commercial custody transfer meter at the point at which custody of the CO_2 from the Permian Basin CO_2 pipeline delivery system is transferred to the SSAU, marked as flow meter M2 on Figure 5. This meter measures flow rate continually. The transfer is a commercial transaction that is documented. In accordance with §98.444(a)(3)(ii), Oxy uses CO_2 concentration data from the commercial sales contract. No CO_2 is received at the SSAU in containers.

6.1.3 CO_2 Injected in the Subsurface

In accordance with §98.444(b)(1), Oxy measures the flow rate of injected CO_2 using the custody transfer meter M2, on Figure 5, and at the outlet of the SGPP, flow meter M3, on Figure 5. In accordance with §98.444(b)(2), the flow rate will be collected quarterly. In accordance with §98.444(b)(3), CO_2 concentration will be sampled at least once per quarter.

6.1.4 CO_2 Produced and Entrained in Products

In accordance with §98.444(c), Oxy measures CO_2 produced at flow meter M4 on Figure 5, that is located at the outlet of the separation unit that sends the CO_2 stream to the injection wells. CO_2 concentration and flow rates will be collected quarterly.

CO_2 that is entrained (i.e., dissolved) in produced oil and natural gas, as indicated in Figure 5, is measured using volumetric flow through the custody transfer meters (M5 and M6).

6.1.5 CO_2 from Equipment Leaks and Vented Emissions of CO_2

In accordance with §98.444(d), Oxy uses 40 CFR §98 Subpart W to estimate the mass of CO_2 emitted from equipment leaks at the SSAU. In accordance with §98.446(f)(3), Oxy will report CO_{2FI} and CO_{2FP}.

6.2 Detection and Quantification of CO_2 Surface Leakage

Oxy uses a multi-layered, risk-based monitoring program for event-driven incidents designed to meet two objectives: 1) to detect problems before CO_2 is emitted by Surface Leakage; and 2) to detect and quantify any CO_2 Surface Leakage that does occur. This section discusses how this monitoring will be conducted and used to quantify the mass of CO_2 Surface Leakage.

6.2.1 Monitoring Potential CO_2 Emissions 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 CO_2 Surface Leakage from the subsurface.

Reservoir simulation modeling, confirmed with 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 CO_2 emissions by Surface Leakage may be occurring. Excursions are

not necessarily indicators of Surface Leakage; 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 CO_2 Surface 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 record in the computerized maintenance management system (CMMS). This record enables the tracking of progress on investigating potential leaks and, if CO_2 has been emitted by Surface Leakage, to quantify its magnitude.

Likewise, a forecast of the rate and composition of produced fluids is developed using the reservoir simulation model. Each producer well is assigned to a specific SAT and is isolated during each cycle for a well production test. The data from the test results are 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 will be initiated. As in the case of injection pattern monitoring, if the investigation leads to a work order in the CMMS, this record will provide the basis for tracking the outcome of the investigation and if a leak has occurred, recording the quantity Surface Leakage. If a CO_2 release in the flood zone were detected, an investigation would be conducted that would include an appropriate method to quantify the mass of any CO_2 confirmed to have been emitted by Surface Leakage. This might include use of material balance equations based on known injected quantities and monitored pressures in the injection zone to estimate the mass of CO_2 involved.

Generally, it is highly unlikely that a subsurface release at SSAU will lead to CO_2 Surface Leakage. In the unlikely event that there are indications of a potential subsurface release, Oxy would determine the appropriate approach for tracking subsurface release to determine whether there was a risk of CO_2 Surface Leakage, address and remedy the release and quantify any actual CO_2 Surface Leakage. To quantify CO_2 Surface Leakage, the relevant parameters (e.g., the rate, concentration, and duration of CO_2 Surface Leakage) would be either be directly measured or estimated to quantify the release mass. Depending on specific circumstances, these determinations may rely on engineering estimates.

In the event a release from the subsurface occurred diffusely through the seals to the surface, the CO_2 Surface Leakage would necessarily include H_2S, which is also present in the SSAU, which would trigger the alarm on the personal monitors worn by field personnel. CO_2 Leakage from the subsurface to the surface have not occurred in the SSAU. If CO_2 Surface Leakage was detected, personnel would use modeling, engineering estimates, and direct measurements to assess, address, and quantify the mass of CO_2 Surface Leakage.

6.2.2. Monitoring of Wellbores

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

CO_2 Surface Leakage from wellbores would be detected through the follow-up investigation of pressure anomalies, visual inspection, or the use of personal H_2S monitors.

Anomalies in injection zone pressure may not indicate CO_2 Surface Leakage. However, if an investigation leads to a work order, field personnel would inspect the equipment in question and determine the nature of the problem. Where possible, repairs will be made with materials on hand and the mass of CO_2 Surface Leakage would be included in the 40 CFR Part §98 Subpart W report for the SSAU. If repairs require additional time and materials, the appropriate approach for quantifying mass of CO_2 Surface Leakage using the relevant parameters (e.g., the rate, concentration, and duration) 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 any identified issues. Where possible, repairs will be made with materials on hand at the time of inspection and the mass of CO_2 Surface Leakage would be included in the 40 CFR Part §98 Subpart W report for SSAU. If repairs require additional time and materials, the affected well would be shut in, a work order would be generated, and the appropriate approach for quantifying the mass of CO_2 Surface Leakage using the relevant parameters (e.g., the rate, concentration, and duration) would be determined. The work order would serve as the basis for tracking the event for GHG reporting.

Because a CO_2 release 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 SSAU is employed to detect unexpected releases from wellbores and surface facilities. 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 CO_2 emissions.

Finally, the data collected by the H_2S monitors, which are always worn by all field personnel, are used as an additional method to detect CO_2 Surface Leakage from wellbores. The H_2S monitors' detection limit is 10 ppm; if an H_2S 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, H_2S is considered a proxy for potential CO_2 Surface Leakage in the field; thus, detected H_2S will be investigated to determine any if confirmed CO_2 Surface Leakage is occurring. If the incident results in a work order, this will serve as the basis for tracking the event for GHG reporting.

6.2.3. Other Potential CO_2 Emissions by Surface Leakage

The same visual inspection process and H_2S monitoring system for identifying potential CO_2 Surface Leakage s from wellbores will be used to detect other potential CO_2 Surface Leakage. Routine visual inspections are used to detect CO_2 Surface Leakage. 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 conducting a general observation of the facility for visible CO_2 emissions. If problems are detected, field personnel would investigate, and, if maintenance is required, generate a work order in the CMMS, which is tracked through completion. In addition to these visual inspections, the results of the personal H_2S monitors worn by field personnel will be used as a supplement to identify CO_2 Surface Leakage that may escape visual detection.

If CO_2 Surface Leakage are detected, they will be reported to surface operations personnel, who will review the reports and conduct a site investigation. If maintenance is required, steps will be taken to prevent further emissions, and a work order will be generated in the CMMS. The work order will describe the appropriate corrective action and be used to track completion of the maintenance action. It will also serve as the basis for tracking the event for GHG reporting and quantifying the mass of CO_2 Surface Leakage.

6.3. Monitoring to Demonstrate that Injected CO_2 Is Not Expected to Migrate to the Surface

At the end of the specified period, Oxy will cease injecting CO_2 for the subsidiary purpose of establishing the long-term storage of CO_2 in the SSAU. Sometime 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 CO_2 reported under 40 CFR §98.440-449 (Subpart RR) is not expected to migrate in the future in a manner likely to result in CO_2 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:

- Data comparing actual performance to predicted performance (purchase, injection, production) over the monitoring period;
- An assessment of the CO_2 Surface Leakage detected, including discussion of the estimated mass of CO_2 emitted and the distribution of emissions by Surface Leakage pathway;
- A demonstration that future operations will not release the injected CO_2 to the surface;
- A demonstration that there has been no significant CO_2 emissions by Surface Leakage; and,
- An evaluation of reservoir pressure that demonstrates that injected fluids are not expected to migrate in a manner to likely to result in Surface Leakage.

7. Determination of Baselines

Existing automatic data systems will be utilized to identify and investigate excursions from expected performance that could indicate CO_2 emissions from the SSAU. Data systems are used primarily for operational control and monitoring and thus 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 CO_2 Surface Leakage will be developed. The following describes the approach to collecting this information.

7.1 Visual Inspections

As field personnel conduct routine inspections, work orders are generated in the CMMS for maintenance activities that cannot be addressed on the spot. Methods to capture work orders that involve activities that could potentially involve CO_2 Surface 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 mass of CO_2 Surface Leakage. Records of information used to calculate emissions will be maintained on file for a minimum of three years.

7.2 Personal H_2S Monitors

Oxy's injection gas compositional analysis indicates H_2S is approximately 1% of the total injected fluid stream. H_2S monitors are worn by all field personnel. The H_2S monitors detect concentrations of H_2S up to 500 ppm in 0.1 ppm increments and will sound an alarm if the detection limit exceeds 10 ppm. If an H_2S 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 H_2S to be a proxy for identifying CO_2 Surface Leakage. The person responsible for MRV documentation will receive notice of all incidents where H_2S 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 of the mass of CO_2 confirmed emitted from any such incidents. Records of information to calculate emissions will be maintained on file for a minimum of three years.

7.3 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 reservoir modeling. The injection targets are programmed into the WAG satellite controllers. High and low set points are also programmed into the controllers, and flags are generated whenever statistically significant deviations from these 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 lead to CO_2 Surface Leakage. The person responsible for the MRV documentation will receive notice of excursions and related work orders that could potentially involve CO_2 Surface Leakage. The Annual Subpart RR Report will provide an estimate of the mass of CO_2 confirmed Surface Leakage. Records of information used to calculate emissions will be maintained on file for a minimum of three years.

7.4 Production Volumes and Compositions

A general forecast of production volumes and composition is developed and used to evaluate performance periodically and refine current and projected injection plans and the forecast. This information is used to make operational decisions, but it is not recorded in an automated data system. Sometimes, this review may result in the generation of a work order in the CMMS. The MRV plan implementation lead will review such work orders and identify those that could result in CO_2 Surface Leakage. Should such events occur, the mass of CO_2 confirmed Surface Leakage 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

This section describes how Oxy uses the equations in Subpart RR §98.443 to calculate the mass of CO_2 received using equations RR-2 and RR-3, the mass of CO_2 injected using equations RR-5

and RR-6, the amount of CO_2 produced using equations RR-8 and RR-9, the mass of CO_2 Surface Leakage using equation RR-10, and the mass of CO_2 sequestered using equation RR-11.

8.1 Mass of CO_2 Received

In accordance with §98.443, Equation RR-2 will be used to calculate the mass of CO_2 Received. In accordance with the requirements at Subpart RR §98.444(a), CO_2 will be measured at the custody transfer meter from the Permian Basin CO_2 pipeline delivery system (M2 on Figure 5). Because there is no redelivery of CO_2, $S_{r,p}$ will be zero ("0"). Quarterly CO_2 concentration will be taken from the gas measurement database. The volumetric flow at standard conditions will be multiplied by the CO_2 concentration and the density of CO_2 at standard conditions to determine net Annual Mass of CO_2 Received.

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

Where:

$CO_{2T,r}$ = Net annual mass of CO_2 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 CO_2 at standard conditions (metric tons per standard cubic meter), 0.0018682;

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

p = Quarter of the year; and

r = Receiving flow meters.

In accordance with §98.443, Equation RR-3 will be used to sum the mass of CO_2 received from all flow meters is calculated in the following equation.

$$CO_2 = \sum_{r=1}^{R} CO_{2T,r} \qquad \text{(Eq. RR-3)}$$

Where:

CO_2 = Total net annual mass of CO_2 received (metric tons).

$CO_{2T,r}$ = Net annual mass of CO_2 received through flow meter r (metric tons).

8.2 Mass of CO_2 Injected into the Subsurface

As described in Section 6.1.3, the amount of CO_2 injected is measured at M2 and M3. In accordance with §98.443, Equation RR-5 will be used to calculate the mass of CO_2 flowing through each of these meters. Quarterly CO_2 concentration will be taken from the gas measurement database. The volumetric flow at standard conditions will be multiplied by the CO_2 concentration and the density of CO_2 at standard conditions to determine net Annual Mass of CO_2 Received.

$$CO_{2,u} = \sum_{p=1}^{4} Q_{p,u} * D * C_{CO2,p,u} \qquad \text{(Eq. RR-5)}$$

Where:

$CO_{2,u}$ = Annual CO_2 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 CO_2 at standard conditions (metric tons per standard cubic meter), 0.0018682;

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

p = Quarter of the year; and

u = Flow meter.

In accordance with §98.443, Equation RR-6 will be used to calculate the total Mass of CO_2 Injected, which is the sum of the Mass of CO_2 from flow meters M2 and M3.

$$CO_{2I} = \sum_{u=1}^{U} CO_{2,u} \qquad \text{(Eq. RR-6)}$$

Where:

$CO_{2,u}$ = Annual CO_2 mass recycled (metric tons) as measured by flow meter u + Net annual mass of CO_2 received through flow meter r (metric tons).

8.3 Mass of CO_2 Produced

In accordance with §98.443, Equation RR-8 will be used the calculate the Mass of CO_2 Produced at flow meter M4 on Figure 5, as described in Section 6.1.4. Quarterly CO_2 concentration will be taken from the gas measurement database. The volumetric flow at standard conditions will be multiplied by the CO_2 concentration and the density of CO_2 at standard conditions to determine net Annual Mass of CO_2 Received.

$$CO_{2w} = \sum_{p=1}^{4} Q_{p,w} * D * C_{CO2,p,w} \quad \text{(Eq. RR-8)}$$

Where:

CO_{2w} = Annual CO_2 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 CO_2 at standard conditions (metric tons per standard cubic meter), 0.0018682;

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

p = Quarter of the year; and

w = Separator.

In accordance with §98.443 Equation RR-9, Oxy will calculate the amount of CO_2 entrained in oil at the custody transfer meters for oil sales, M4.

$$CO_{2,p} = (1+X) * \sum_{w=1}^{W} CO_{2,w} \quad \text{(Eq. RR-9)}$$

Where:

$CO_{2,p}$ = Total annual CO_2 mass produced (metric tons) through all meters in the reporting year;

$CO_{2,w}$ = Annual CO_2 mass produced (metric tons) through meter w in the reporting year;

X = Entrained CO_2 in produced oil or other fluid divided by the CO_2 separated through all separators in the reporting year (weight percent CO_2, expressed as a decimal fraction);

w = Separator

8.4 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 events. Oxy is prepared to address the potential for CO_2 Surface Leakage in a variety of settings. Estimates of the mass of confirmed CO_2 Surface Leakage will depend on several site-specific factors including measurements, engineering estimates, and emission factors, depending on the source and nature of the CO_2 Surface Leakage.

The process for quantifying the mass of CO_2 Surface Leakage will entail using best engineering principles or emission factors. While it is not possible to predict in advance all the types of events that may lead to CO_2 Surface Leakage, some approaches for quantification are described in Sections 5.9 and 6. In the event CO_2 Surface Leakage is confirmed the mass of CO_2 Surface Leakage would be quantified and reported, and records that describe the methods used to estimate or measure the mass emitted 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 the mass of CO_2 Surface Leakage are not double-counted.

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

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

Where:

CO_{2E} = Total annual CO_2 mass emitted by Surface Leakage (metric tons) in the reporting year;

CO_{2x} = Annual CO_2 mass emitted (metric tons) at leakage pathway x in the reporting year; and

x = Leakage pathway.

8.5 Mass of CO_2 Sequestered in Subsurface Geologic Formation

In accordance with §98.443, Equation RR-11 will be used to calculate the Mass of CO_2 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:

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.

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.

8.6 Cumulative Mass of CO_2 Reported as Sequestered in Subsurface Geologic Formation

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

9. MRV Plan Implementation Schedule

This MRV plan will be implemented starting January 1, 2023. GHG reports are filed on March 31 of the year after the reporting year, and Oxy anticipates that the Annual Subpart RR Report will be filed at the same time. Oxy anticipates that the MRV program will be in effect during the specified period, during which time one of the operating purposes will be to establish long-term containment of a measurable quantity of CO_2 in subsurface geological formations at the SSAU.

Oxy anticipates that it will be able to demonstrate that a quantifiable mass of CO_2 injected during the specified period will be stored such that it will not migrate in the future in a manner that likely to result in Surface Leakage. At the end of the specified period, 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:

10.1.1 CO_2 Received and Injected

- The quarterly flow rate of CO_2 received by pipeline is measured at the receiving custody transfer meters.
- The quarterly CO_2 flow rate for recycled CO_2 is measured at the flow meter located at the SGPP outlet.

10.1.2 CO_2 Produced

- The point of measurement for the quantity of CO_2 produced from oil or other fluid production wells is a flow meter at the outlet 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 SGPP flow meter used to measure flow rate of the gas stream, and the CO_2 concentration of the sample will be measured.
- The quarterly flow rate of the produced gas is measured at the flow meters located at the SGPP outlet.

10.1.3 CO_2 Emissions from Equipment Leaks and Vented Emissions of CO_2

The mass of CO_2 emitted from equipment leaks and vented emissions are measured in conformance with the monitoring and QA/QC requirements specified in Subpart W of 40 CFR Part §98.

10.1.4 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 either industry standard practices or an appropriate standard method published by a consensus-based standards organization; and,
- Calibrated, when necessary, using National Institute of Standards and Technology (NIST) methods that are traceable.

10.1.5 Concentration of CO_2

CO_2 concentration is measured using an industry standard practice or an appropriate standard method. Further, all measured CO_2 has been converted to standard cubic meters at a temperature of 60°F 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 CO_2 received that is missing will be estimated using invoices or using a representative flow rate value from the nearest previous time period.
- A quarterly CO_2 concentration of a CO_2 stream received that is missing will be estimated using invoices or using a representative concentration value from the nearest previous time period.
- A quarterly quantity of CO_2 injected that is missing will be estimated using a representative quantity of CO_2 injected from the nearest previous time period at a similar injection pressure.
- For any values associated with CO_2 emissions from equipment leaks and vented emissions of CO_2 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 will be followed.
- The quarterly quantity of CO_2 produced from subsurface geologic formations that is missing will be estimated using a representative quantity of CO_2 produced from the nearest previous time period.

10.3 MRV Plan Revisions

Within 180 days of a material change to the monitoring and/or operational parameters of the CO_2 EOR operations in the SSAU that is not anticipated in this MRV plan, a change in UIC permit class, EPA notification of substantive errors in this MRV plan or monitoring report, or if Oxy chooses to revise this MRV plan, the MRV plan will be revised and submitted to the EPA Administrator 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 CO_2 received at standard conditions and operating conditions, operating temperature and pressure, and concentration of these streams.
- Quarterly records of produced CO_2, including volumetric flow at standard conditions and operating conditions, operating temperature and pressure, and concentration of these streams.
- Quarterly records of injected CO_2 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 CO_2 emitted by Surface Leakage.
- 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 flow meter used to measure injection quantity and the injection wellhead.
- 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 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

Table 4 presents the well name and number, API number, type, and status for active wells in SSAU 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 CO_2 gas.
  - INJ_WAG refers to wells that inject water and CO_2 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.

Table 4—SSAU Well Numbers, Types, and Status

The Well Name & Number, API Number, Well Type, and Well Status are all from OXYODS.MDMODS.Well_All. They include only Oxy Operated wells with a field name like SEMINOLE (SAN ANDRES).

Well Name & Number from OXYODS	API Number	Well Type	Well Status as of November 2022
SSAU-3901	42165000220000	INJ_WAG	ACTIVE
SSAU-1301	42165000230000	PROD_OIL	ACTIVE
SSAU-0701	42165000240000	PROD_OIL	ACTIVE
SSAU-3902	42165000250000	INJ_WAG	ACTIVE
SSAU-1302	42165000260000	INJ_WAG	ACTIVE
SSAU-0702	42165000270000	INJ_WAG	ACTIVE
SSAU-3903	42165000290000	PROD_OIL	P & A
SSAU-1303	42165000300000	PROD_OIL	TA
SSAU-0703	42165000310000	PROD_OIL	ACTIVE
SSAU-3904	42165000320000	PROD_OIL	ACTIVE
SSAU-1304	42165000330000	PROD_OIL	ACTIVE
SSAU-0704	42165000340000	PROD_OIL	P & A
SSAU-3905W	42165000350000	INJ_WAG	ACTIVE
SSAU-0705	42165000360000	PROD_OIL	ACTIVE
SSAU-3906	42165000370000	PROD_OIL	ACTIVE
SSAU-1306	42165000380000	INJ_WAG	ACTIVE
SSAU-0706	42165000390000	INJ_H2O	ACTIVE
SSAU-3907	42165000400000	PROD_OIL	ACTIVE
SSAU-0707	42165000410000	INJ_H2O	ACTIVE
SSAU-3908	42165000420000	INJ_WAG	ACTIVE
SSAU-1102	42165000520000	INJ_WAG	P & A
SSAU-1202	42165000650000	PROD_OIL	ACTIVE
SSAU-3602	42165000660000	PROD_OIL	TA
SSAU-4801	42165000670000	PROD_OIL	ACTIVE
SSAU-1201	42165000690000	INJ_H2O	P & A
SSAU-4302	42165000720000	PROD_OIL	ACTIVE
SSAU-4303W	42165000730000	INJ_WAG	ACTIVE
SSAU-4304	42165000740000	INJ_WAG	ACTIVE
SSAU-4305	42165000750000	INJ_WAG	ACTIVE
SSAU-4306	42165000760000	INJ_WAG	ACTIVE
SSAU-4307	42165000770000	INJ_WAG	ACTIVE
SSAU-4308	42165000780000	INJ_WAG	ACTIVE
SSAU-4309	42165000790000	PROD_OIL	TA
SSAU-0401	42165000820000	INJ_H2O	ACTIVE

SSAU-0501	42165000830000	INJ_H2O	ACTIVE
SSAU-0402	42165000840000	PROD_OIL	P & A
SSAU-0502	42165000850000	PROD_OIL	ACTIVE
SSAU-0801	42165000980000	PROD_OIL	ACTIVE
SSAU-3501W	42165000990000	INJ_H2O	TA
SSAU-3502	42165001000000	PROD_OIL	ACTIVE
SSAU-3503	42165001010000	INJ_WAG	ACTIVE
SSAU-3504	42165001020000	INJ_WAG	SHUT-IN
SSAU-3505	42165001030000	INJ_WAG	ACTIVE
SSAU-3506	42165001040000	PROD_OIL	TA
SSAU-3507W	42165001050000	INJ_WAG	ACTIVE
SSAU-3508	42165001060000	PROD_OIL	ACTIVE
SSAU-3509	42165001070000	INJ_WAG	SHUT-IN
SSAU-3510	42165001080000	INJ_WAG	TA
SSAU-3511	42165001090000	INJ_WAG	ACTIVE
SSAU-3512	42165001100000	PROD_OIL	P & A
SSAU-3513W	42165001110000	INJ_WAG	ACTIVE
SSAU-3514	42165001120000	INJ_WAG	ACTIVE
SSAU-3515	42165001130000	PROD_OIL	P & A
SSAU-3516	42165001140000	PROD_OIL	TA
SSAU-6401	42165001700000	PROD_OIL	ACTIVE
SSAU-6402	42165001710000	INJ_WAG	ACTIVE
SSAU-6403	42165001720000	PROD_OIL	ACTIVE
SSAU-6404	42165001730000	PROD_OIL	ACTIVE
SSAU-6405	42165001740000	PROD_OIL	ACTIVE
SSAU-6406W	42165001750000	INJ_H2O	TA
SSAU-6407	42165001760000	PROD_OIL	ACTIVE
SSAU-2401W	42165001880000	INJ_WAG	ACTIVE
SSAU-2402	42165001890000	PROD_OIL	ACTIVE
SSAU-2403	42165001900000	PROD_OIL	ACTIVE
SSAU-2404	42165001910000	INJ_WAG	ACTIVE
SSAU-6001	42165001920000	PROD_OIL	TA
SSAU-5301	42165001930000	INJ_WAG	ACTIVE
SSAU-5302	42165001940000	PROD_OIL	ACTIVE
SSAU-5303	42165001950000	PROD_OIL	ACTIVE
SSAU-5304W	42165001960000	INJ_WAG	ACTIVE
SSAU-5305	42165001970000	INJ_WAG	ACTIVE
SSAU-5306	42165001980000	PROD_OIL	ACTIVE
SSAU-5307	42165001990000	PROD_OIL	ACTIVE
SSAU-5308W	42165002000000	INJ_WAG	P & A
SSAU-2701	42165002040000	INJ_WAG	ACTIVE

SSAU-2702	42165002050000	PROD_OIL	ACTIVE
SSAU-2703W	42165002060000	INJ_WAG	ACTIVE
SSAU-2704W	42165002070000	INJ_WAG	ACTIVE
SSAU-2705	42165002080000	PROD_OIL	ACTIVE
SSAU-2706	42165002090000	PROD_OIL	ACTIVE
SSAU-2707	42165002160000	INJ_WAG	ACTIVE
SSAU-2708	42165002170000	PROD_OIL	ACTIVE
SSAU-0601	42165002270000	INJ_H2O	ACTIVE
SSAU-4001	42165002290000	PROD_OIL	P & A
SSAU-1401	42165002300000	PROD_OIL	ACTIVE
SSAU-3701	42165002310000	INJ_WAG	ACTIVE
SSAU-4002W	42165002320000	INJ_WAG	ACTIVE
SSAU-1402W	42165002330000	INJ_H2O	P & A
SSAU-3702	42165002340000	PROD_OIL	ACTIVE
SSAU-4003	42165002350000	INJ_H2O	P & A
SSAU-1403	42165002360000	INJ_WAG	ACTIVE
SSAU-4004	42165002370000	PROD_OIL	ACTIVE
SSAU-1404	42165002380000	PROD_OIL	ACTIVE
SSAU-4005	42165002390000	INJ_H2O	P & A
SSAU-1405	42165002400000	PROD_OIL	ACTIVE
SSAU-4006	42165002410000	PROD_OIL	ACTIVE
SSAU-1406	42165002420000	INJ_WAG	ACTIVE
SSAU-4007	42165002430000	PROD_OIL	INACTIVE
SSAU-1407	42165002440000	PROD_OIL	ACTIVE
SSAU-4008	42165002450000	INJ_WAG	ACTIVE
SSAU-1408	42165002460000	INJ_H2O	P & A
SSAU-3601	42165002520000	INJ_H2O	TA
SSAU-1504	42165002570000	PROD_OIL	ACTIVE
SSAU-1505W	42165002580000	INJ_WAG	P & A
SSAU-1506	42165002590000	INJ_WAG	ACTIVE
SSAU-1507	42165002600000	PROD_OIL	ACTIVE
SSAU-5901	42165002630000	PROD_OIL	ACTIVE
SSAU-5902	42165002640000	PROD_OIL	TA
SSAU-3801	42165002690000	INJ_WAG	INACTIVE
SSAU-3802	42165002700000	PROD_OIL	INACTIVE
SSAU-3803	42165002710000	PROD_OIL	P & A
SSAU-3804	42165002720000	PROD_OIL	ACTIVE
SSAU-3805	42165002730000	PROD_OIL	INACTIVE
SSAU-3806	42165002740000	INJ_H2O	ACTIVE
SSAU-1901	42165002800000	PROD_OIL	ACTIVE
SSAU-1902	42165002820000	INJ_WAG	ACTIVE

SSAU-1903	42165002830000	PROD_OIL	ACTIVE
SSAU-1904	42165002840000	PROD_OIL	ACTIVE
SSAU-1905A	42165002850000	PROD_OIL	ACTIVE
SSAU-3301	42165002920000	INJ_WAG	P & A
SSAU-3302	42165002930000	PROD_OIL	ACTIVE
SSAU-3303	42165002940000	INJ_WAG	INACTIVE
SSAU-3304	42165002950000	PROD_OIL	ACTIVE
SSAU-1801	42165003180000	INJ_WAG	ACTIVE
SSAU-1305	42165003400000	PROD_OIL	P & A
SSAU-6408	42165003410000	INJ_H2O	ACTIVE
SSAU-0201	42165003420000	PROD_OIL	TA
SSAU-0202	42165003430000	INJ_H2O	INACTIVE
SSAU-5101	42165003440000	INJ_WAG	ACTIVE
SSAU-5102	42165003450000	INJ_WAG	ACTIVE
SSAU-5103	42165003460000	PROD_OIL	ACTIVE
SSAU-1501	42165003620000	PROD_OIL	ACTIVE
SSAU-1502	42165003630000	INJ_WAG	ACTIVE
SSAU-1503	42165003690000	PROD_OIL	TA
SSAU-6301	42165003870000	PROD_OIL	ACTIVE
SSAU-6302	42165003880000	PROD_OIL	ACTIVE
SSAU-6303	42165003890000	PROD_OIL	ACTIVE
SSAU-6304	42165003900000	INJ_WAG	ACTIVE
SSAU-6305	42165003910000	INJ_H2O	ACTIVE
SSAU-6306	42165003920000	PROD_OIL	ACTIVE
SSAU-6307	42165003930000	INJ_H2O	ACTIVE
SSAU-6308	42165003940000	PROD_OIL	INACTIVE
SSAU-7301	42165004090000	PROD_OIL	ACTIVE
SSAU-7302	42165004100000	PROD_OIL	ACTIVE
SSAU-8201	42165004110000	PROD_OIL	INACTIVE
SSAU-8202	42165004120000	PROD_OIL	P & A
SSAU-8203	42165004130000	PROD_OIL	P & A
SSAU-7701	42165004140000	PROD_OIL	ACTIVE
SSAU-7702	42165004150000	INJ_H2O	ACTIVE
SSAU-8101	42165004160000	PROD_OIL	INACTIVE
SSAU-8102	42165004170000	PROD_OIL	ACTIVE
SSAU-8103	42165004180000	PROD_OIL	INACTIVE
SSAU-8104	42165004190000	INJ_H2O	ACTIVE
SSAU-7401W	42165004230000	INJ_H2O	P & A
SSAU-6101	42165004240000	PROD_OIL	ACTIVE
SSAU-4501	42165008710000	PROD_OIL	P & A
SSAU-8401	42165009570000	INJ_H2O	P & A

SSAU-5601	42165009880000	PROD_OIL	ACTIVE
SSAU-5602	42165009890000	PROD_OIL	P & A
SSAU-5603	42165009900000	PROD_OIL	P & A
SSAU-3001	42165011170000	PROD_OIL	INACTIVE
SSAU-0301	42165011180000	PROD_OIL	P & A
SSAU-3401W	42165011950000	INJ_WAG	ACTIVE
SSAU-3402	42165012040000	PROD_OIL	ACTIVE
SSAU-3403	42165012050000	PROD_OIL	ACTIVE
SSAU-3404	42165012060000	INJ_WAG	ACTIVE
SSAU-2807	42165012130000	PROD_OIL	ACTIVE
SSAU-2808	42165012140000	INJ_WAG	ACTIVE
SSAU-1601	42165012320000	INJ_WAG	ACTIVE
SSAU-1602	42165012330000	PROD_OIL	ACTIVE
SSAU-1603	42165012340000	PROD_OIL	ACTIVE
SSAU-1604	42165012350000	INJ_WAG	ACTIVE
SSAU-1605	42165012360000	PROD_OIL	ACTIVE
SSAU-1606W	42165012370000	INJ_WAG	ACTIVE
SSAU-1607	42165012380000	PROD_OIL	ACTIVE
SSAU-1608	42165012390000	INJ_WAG	ACTIVE
SSAU-2601	42165012430000	PROD_OIL	P & A
SSAU-2501	42165012770000	PROD_OIL	ACTIVE
SSAU-2801	42165012830000	PROD_OIL	P & A
SSAU-2802	42165012840000	INJ_WAG	SHUT-IN
SSAU-2803	42165012850000	PROD_OIL	ACTIVE
SSAU-2804	42165012860000	INJ_WAG	ACTIVE
SSAU-2805W	42165012870000	INJ_WAG	ACTIVE
SSAU-2806	42165012880000	PROD_OIL	ACTIVE
SSAU-0903	42165014280000	INJ_WAG	P & A
SSAU-0902	42165014290000	PROD_OIL	P & A
SSAU-0901W	42165014300000	INJ_WAG	P & A
SSAU-5701	42165014410000	PROD_OIL	P & A
SSAU-0101	42165015120000	INJ_H2O	TA
SSAU-2001	42165015590000	PROD_OIL	P & A
SSAU-0102	42165015620000	PROD_OIL	P & A
SSAU-2202	42165015770000	PROD_OIL	ACTIVE
SSAU-7512	42165015790000	PROD_OIL	P & A
SSAU-5516	42165015800000	INJ_WAG	ACTIVE
SSAU-4101	42165017730000	INJ_WAG	ACTIVE
SSAU-6501	42165017790000	PROD_OIL	P & A
SSAU-6502	42165017800000	INJ_H2O	P & A
SSAU-6503	42165017810000	PROD_OIL	P & A

SSAU-7501	42165017830000	PROD_OIL	ACTIVE
SSAU-7502	42165017840000	PROD_OIL	INACTIVE
SSAU-7503	42165017850000	PROD_OIL	P & A
SSAU-7504	42165017860000	PROD_OIL	ACTIVE
SSAU-7505	42165017870000	PROD_OIL	ACTIVE
SSAU-7506W	42165017880000	INJ_H2O	ACTIVE
SSAU-7507W	42165017890000	INJ_H2O	ACTIVE
SSAU-7508	42165017900000	PROD_OIL	ACTIVE
SSAU-7509	42165017910000	PROD_OIL	INACTIVE
SSAU-7510	42165017920000	PROD_OIL	ACTIVE
SSAU-7511	42165017930000	INJ_H2O	ACTIVE
SSAU-5501	42165017940000	PROD_OIL	ACTIVE
SSAU-5502	42165017950000	INJ_WAG	ACTIVE
SSAU-5503	42165017960000	PROD_OIL	P & A
SSAU-5504W	42165017970000	INJ_WAG	ACTIVE
SSAU-5505	42165017980000	PROD_OIL	P & A
SSAU-5506	42165017990000	INJ_WAG	ACTIVE
SSAU-5507	42165018000000	PROD_OIL	ACTIVE
SSAU-5508	42165018010000	INJ_WAG	ACTIVE
SSAU-5509	42165018020000	INJ_WAG	ACTIVE
SSAU-5510	42165018030000	PROD_OIL	ACTIVE
SSAU-5511W	42165018040000	INJ_WAG	ACTIVE
SSAU-5512	42165018050000	PROD_OIL	P & A
SSAU-5513	42165018060000	PROD_OIL	TA
SSAU-5514	42165018070000	PROD_OIL	P & A
SSAU-5515	42165018080000	PROD_OIL	P & A
SSAU-2901	42165018090000	PROD_OIL	ACTIVE
SSAU-2902	42165018100000	INJ_WAG	ACTIVE
SSAU-2903	42165018110000	PROD_OIL	P & A
SSAU-2904W	42165018120000	INJ_WAG	ACTIVE
SSAU-2905	42165018130000	INJ_WAG	SHUT-IN
SSAU-2906	42165018140000	INJ_WAG	ACTIVE
SSAU-2907	42165018150000	PROD_OIL	ACTIVE
SSAU-2908	42165018160000	INJ_WAG	ACTIVE
SSAU-2909	42165018170000	INJ_WAG	TA
SSAU-2910	42165018180000	PROD_OIL	ACTIVE
SSAU-2911	42165018190000	PROD_OIL	TA
SSAU-2912	42165018200000	PROD_OIL	ACTIVE
SSAU-2913W	42165018210000	INJ_H2O	INACTIVE
SSAU-2914	42165018220000	INJ_H2O	ACTIVE
SSAU-4102	42165018230000	PROD_OIL	ACTIVE

SSAU-4103	42165018240000	PROD_OIL	ACTIVE
SSAU-4104W	42165018250000	INJ_WAG	ACTIVE
SSAU-4105	42165018260000	PROD_OIL	ACTIVE
SSAU-4106	42165018270000	PROD_OIL	TA
SSAU-4107	42165018280000	INJ_WAG	ACTIVE
SSAU-4108W	42165018290000	INJ_WAG	ACTIVE
SSAU-4109	42165018300000	PROD_OIL	ACTIVE
SSAU-4110	42165018310000	INJ_WAG	ACTIVE
SSAU-4111	42165018320000	PROD_OIL	ACTIVE
SSAU-4114	42165018330000	INJ_WAG	ACTIVE
SSAU-4116	42165018340000	INJ_WAG	ACTIVE
SSAU-4115	42165018350000	PROD_OIL	ACTIVE
SSAU-4112	42165018360000	INJ_WAG	ACTIVE
SSAU-4113	42165018370000	PROD_OIL	P & A
SSAU-6201	42165018380000	INJ_WAG	ACTIVE
SSAU-6202	42165018390000	PROD_OIL	ACTIVE
SSAU-6203	42165018400000	INJ_WAG	ACTIVE
SSAU-6204	42165018410000	INJ_H2O	ACTIVE
SSAU-6205	42165018420000	PROD_OIL	ACTIVE
SSAU-6206	42165018430000	PROD_OIL	ACTIVE
SSAU-6208	42165018440000	PROD_OIL	P & A
SSAU-6209	42165018450000	INJ_H2O	ACTIVE
SSAU-6210	42165018460000	PROD_OIL	ACTIVE
SSAU-3101	42165018470000	PROD_OIL	ACTIVE
SSAU-3102	42165018480000	INJ_WAG	ACTIVE
SSAU-3103	42165018490000	PROD_OIL	ACTIVE
SSAU-3107	42165018510000	INJ_WAG	P & A
SSAU-3108	42165018520000	PROD_OIL	ACTIVE
SSAU-3109	42165018530000	PROD_OIL	ACTIVE
SSAU-3110	42165018540000	INJ_H2O	ACTIVE
SSAU-3111	42165018550000	PROD_OIL	ACTIVE
SSAU-3106	42165018560000	INJ_WAG	ACTIVE
SSAU-2204	42165018570000	PROD_OIL	ACTIVE
SSAU-2201	42165018580000	INJ_WAG	ACTIVE
SSAU-2203	42165018590000	INJ_WAG	ACTIVE
SSAU-2205	42165018600000	PROD_OIL	P & A
SSAU-2206	42165018610000	PROD_OIL	ACTIVE
SSAU-2208	42165018620000	INJ_WAG	ACTIVE
SSAU-2207	42165018630000	PROD_OIL	INACTIVE
SSAU-2209	42165018640000	PROD_OIL	ACTIVE
SSAU-2210	42165018650000	INJ_WAG	ACTIVE

SSAU-2211	42165018660000	PROD_OIL	ACTIVE
SSAU-3104	42165018730000	INJ_H2O	P & A
SSAU-6207	42165018740000	PROD_OIL	ACTIVE
SSAU-7601	42165018800000	PROD_OIL	ACTIVE
SSAU-7602	42165018810000	PROD_OIL	ACTIVE
SSAU-7603	42165018820000	INJ_H2O	TA
SSAU-7604	42165018830000	PROD_OIL	P & A
SSAU-7001	42165018870000	PROD_OIL	ACTIVE
SSAU-4901	42165020110000	PROD_OIL	ACTIVE
SSAU-4902	42165020120000	PROD_OIL	P & A
SSAU-4903	42165020130000	PROD_OIL	ACTIVE
SSAU-4904	42165020140000	INJ_WAG	ACTIVE
SSAU-4905	42165020150000	PROD_OIL	ACTIVE
SSAU-3201	42165020170000	PROD_OIL	P & A
SSAU-3202	42165020180000	INJ_WAG	INACTIVE
SSAU-3203	42165020190000	PROD_OIL	ACTIVE
SSAU-3204	42165020200000	INJ_WAG	ACTIVE
SSAU-3205	42165020210000	PROD_OIL	TA
SSAU-3206	42165020220000	INJ_WAG	ACTIVE
SSAU-3207	42165020230000	PROD_OIL	ACTIVE
SSAU-3208	42165020240000	INJ_WAG	ACTIVE
SSAU-2301	42165020250000	PROD_OIL	ACTIVE
SSAU-2302	42165020260000	INJ_WAG	ACTIVE
SSAU-2303	42165020270000	PROD_OIL	INACTIVE
SSAU-2304W	42165020280000	INJ_WAG	P & A
SSAU-2305	42165020290000	PROD_OIL	ACTIVE
SSAU-2306	42165020300000	INJ_WAG	ACTIVE
SSAU-2307	42165020310000	PROD_OIL	ACTIVE
SSAU-2308	42165020320000	INJ_WAG	ACTIVE
SSAU-2101	42165020630000	PROD_OIL	ACTIVE
SSAU-1701	42165020650000	PROD_OIL	ACTIVE
SSAU-1702	42165020660000	PROD_OIL	ACTIVE
SSAU-1101	42165020680000	PROD_OIL	ACTIVE
SSAU-1001	42165020690000	PROD_OIL	ACTIVE
SSAU-1002W	42165020700000	INJ_WAG	ACTIVE
SSAU-1003	42165020710000	INJ_WAG	ACTIVE
SSAU-1004	42165020720000	PROD_OIL	ACTIVE
SSAU-1005	42165020730000	PROD_OIL	ACTIVE
SSAU-1006W	42165020740000	INJ_WAG	ACTIVE
SSAU-1007	42165020750000	PROD_OIL	ACTIVE
SSAU-1008	42165020760000	INJ_WAG	ACTIVE

SSAU-1009	42165020770000	PROD_OIL	ACTIVE
SSAU-1010	42165020790000	INJ_WAG	ACTIVE
SSAU-5201A	42165024290000	PROD_OIL	ACTIVE
SSAU-5202	42165024300000	INJ_WAG	ACTIVE
SSAU-5203	42165024310000	PROD_OIL	P & A
SSAU-5204A	42165024330000	INJ_WAG	ACTIVE
SSAU-5401	42165025670000	PROD_OIL	ACTIVE
SSAU-5402	42165025680000	PROD_OIL	ACTIVE
SSAU-5403	42165025690000	INJ_WAG	P & A
SSAU-5404W	42165025700000	INJ_WAG	ACTIVE
SSAU-4201	42165025740000	INJ_WAG	P & A
SSAU-4202	42165025750000	PROD_OIL	TA
SSAU-4203	42165025760000	INJ_WAG	P & A
SSAU-4204	42165025770000	INJ_WAG	ACTIVE
SSAU-7513	42165025950000	PROD_OIL	P & A
SSAU-3105A	42165025990000	PROD_OIL	P & A
SSAU-2602A	42165028350000	INJ_WAG	ACTIVE
SSAU-2502	42165028520000	INJ_WAG	ACTIVE
SSAU-5801	42165032350000	PROD_OIL	TA
SSAU-5702	42165032360000	PROD_OIL	P & A
SSAU-5704	42165032380000	PROD_OIL	TA
SSAU-5705	42165032390000	INJ_H2O	P & A
SSAU-6901	42165032410000	PROD_OIL	P & A
SSAU-7201	42165033030000	PROD_OIL	ACTIVE
SSAU-5001A	42165033170000	INJ_WAG	ACTIVE
SSAU-2214	42165100130000	PROD_OIL	ACTIVE
SSAU-2603	42165100340000	PROD_OIL	ACTIVE
SSAU-4310	42165100700000	PROD_OIL	P & A
SSAU-1508	42165100770000	PROD_OIL	P & A
SSAU-3703	42165101260000	PROD_OIL	P & A
SSAU-3209	42165101610000	PROD_OIL	ACTIVE
SSAU-1906	42165101920000	PROD_OIL	P & A
SSAU-4311	42165101990000	PROD_OIL	ACTIVE
SSAU-4312	42165102000000	PROD_OIL	TA
SSAU-0503	42165102010000	INJ_H2O	P & A
SSAU-3114W	42165106050000	INJ_H2O	P & A
SSAU-3113	42165106300000	PROD_OIL	P & A
SSAU-6211	42165300130000	INJ_H2O	ACTIVE
SSAU-3807	42165300140000	INJ_H2O	P & A
SSAU-3704	42165300150000	INJ_H2O	ACTIVE
SSAU-0403	42165300160000	INJ_H2O	P & A

SSAU-6212	42165300170000	INJ_H2O	ACTIVE
SSAU-7202	42165300180000	INJ_H2O	INACTIVE
SSAU-4907	42165300540000	INJ_H2O	ACTIVE
SSAU-2213	42165300550000	INJ_H2O	TA
SSAU-0303	42165300560000	INJ_H2O	P & A
SSAU-0603	42165300570000	INJ_H2O	ACTIVE
SSAU-4602	42165301250000	INJ_H2O	TA
SSAU-4401	42165301260000	INJ_H2O	ACTIVE
SSAU-2003	42165301270000	INJ_H2O	INACTIVE
SSAU-1907	42165301280000	INJ_H2O	P & A
SSAU-1802	42165301290000	INJ_H2O	TA
SSAU-4802	42165301300000	INJ_H2O	TA
SSAU-8204	42165301310000	INJ_H2O	TA
SSAU-3105R	42165303490000	PROD_OIL	P & A
SSAU-5514R	42165304820000	INJ_WAG	ACTIVE
SSAU-7514	42165304840000	INJ_H2O	ACTIVE
SSAU-1803	42165304850000	INJ_H2O	ACTIVE
SSAU-2915	42165304890000	PROD_OIL	ACTIVE
SSAU-2405	42165305540000	INJ_WAG	ACTIVE
SSAU-3910	42165305550000	PROD_OIL	P & A
SSAU-2406	42165305660000	PROD_OIL	ACTIVE
SSAU-2505	42165305670000	PROD_OIL	TA
SSAU-2504	42165305680000	INJ_WAG	ACTIVE
SSAU-2310	42165311550000	PROD_OIL	ACTIVE
SSAU-4902R	42165311560000	INJ_WAG	ACTIVE
SSAU-2710	42165311570000	INJ_WAG	ACTIVE
SSAU-2810	42165311580000	PROD_OIL	ACTIVE
SSAU-2809	42165311590000	INJ_WAG	ACTIVE
SSAU-2309	42165311600000	PROD_OIL	ACTIVE
SSAU-2312	42165311610000	PROD_OIL	ACTIVE
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SSAU-2709	42165311760000	PROD_OIL	ACTIVE
SSAU-3119	42165312170000	PROD_OIL	ACTIVE
SSAU-2218	42165312530000	INJ_WAG	ACTIVE
SSAU-2219	42165312540000	PROD_OIL	ACTIVE
SSAU-2217	42165312550000	INJ_WAG	ACTIVE
SSAU-2216	42165312560000	PROD_OIL	ACTIVE
SSAU-2712	42165312640000	INJ_WAG	ACTIVE
SSAU-2711	42165312650000	PROD_OIL	ACTIVE
SSAU-2811	42165312660000	INJ_WAG	ACTIVE
SSAU-2812	42165312670000	PROD_OIL	ACTIVE

SSAU-3116	42165313540000	INJ_WAG	ACTIVE
SSAU-3306	42165313640000	INJ_WAG	ACTIVE
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SSAU-3305	42165313660000	PROD_OIL	ACTIVE
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SSAU-3213	42165313720000	INJ_WAG	ACTIVE
SSAU-3212	42165313730000	PROD_OIL	ACTIVE
SSAU-3519	42165313780000	INJ_WAG	ACTIVE
SSAU-3406	42165313790000	INJ_WAG	ACTIVE
SSAU-3517	42165313800000	INJ_WAG	ACTIVE
SSAU-3405	42165313810000	PROD_OIL	ACTIVE
SSAU-3520	42165313820000	PROD_OIL	P & A
SSAU-3118	42165313830000	INJ_WAG	ACTIVE
SSAU-2220	42165313840000	INJ_WAG	ACTIVE
SSAU-3518	42165313850000	PROD_OIL	ACTIVE
SSAU-3117	42165313860000	PROD_OIL	ACTIVE
SSAU-3115	42165314520000	PROD_OIL	ACTIVE
SSAU-3521	42165314660000	INJ_WAG	ACTIVE
SSAU-4313	42165318840000	PROD_OIL	ACTIVE
SSAU-4314	42165318850000	PROD_OIL	P & A
SSAU-4119	42165318860000	INJ_WAG	ACTIVE
SSAU-4315	42165318870000	PROD_OIL	ACTIVE
SSAU-4117	42165318880000	INJ_WAG	ACTIVE
SSAU-4118	42165318890000	PROD_OIL	P & A
SSAU-4011	42165318920000	INJ_WAG	ACTIVE
SSAU-4009	42165318930000	PROD_OIL	ACTIVE
SSAU-0708	42165319020000	PROD_OIL	ACTIVE
SSAU-0709	42165319030000	PROD_OIL	ACTIVE
SSAU-0904	42165319040000	PROD_OIL	ACTIVE
SSAU-1103	42165319050000	PROD_OIL	ACTIVE
SSAU-1308	42165319060000	PROD_OIL	ACTIVE
SSAU-1512	42165319070000	PROD_OIL	TA
SSAU-1511	42165319080000	PROD_OIL	ACTIVE
SSAU-1307	42165319090000	PROD_OIL	ACTIVE
SSAU-1510	42165319100000	PROD_OIL	ACTIVE
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SSAU-4010	42165319210000	PROD_OIL	ACTIVE
SSAU-4012	42165319220000	PROD_OIL	ACTIVE
SSAU-4015	42165319250000	INJ_WAG	ACTIVE
SSAU-4120	42165319260000	PROD_OIL	ACTIVE
SSAU-4121	42165319270000	INJ_WAG	ACTIVE

SSAU-4122	42165319280000	PROD_OIL	ACTIVE
SSAU-4316	42165319290000	PROD_OIL	ACTIVE
SSAU-4317	42165319300000	PROD_OIL	ACTIVE
SSAU-4318	42165319310000	PROD_OIL	P & A
SSAU-4319	42165319320000	PROD_OIL	INACTIVE
SSAU-4320	42165319330000	PROD_OIL	ACTIVE
SSAU-4908	42165319340000	PROD_OIL	ACTIVE
SSAU-1011	42165319350000	PROD_OIL	TA
SSAU-0802	42165319360000	PROD_OIL	ACTIVE
SSAU-1203	42165319430000	PROD_OIL	ACTIVE
SSAU-4123	42165319900000	INJ_WAG	ACTIVE
SSAU-4322	42165319910000	PROD_OIL	P & A
SSAU-4205	42165319920000	PROD_OIL	INACTIVE
SSAU-4126	42165319930000	PROD_OIL	ACTIVE
SSAU-1310	42165320070000	PROD_OIL	ACTIVE
SSAU-4018	42165320080000	INJ_WAG	ACTIVE
SSAU-4019	42165320090000	PROD_OIL	ACTIVE
SSAU-4321	42165320100000	PROD_OIL	ACTIVE
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SSAU-1513	42165320260000	PROD_OIL	ACTIVE
SSAU-1412	42165320270000	PROD_OIL	ACTIVE
SSAU-1309	42165320280000	PROD_OIL	ACTIVE
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SSAU-1012	42165320310000	PROD_OIL	ACTIVE
SSAU-0905	42165320320000	PROD_OIL	ACTIVE
SSAU-0710	42165320330000	PROD_OIL	ACTIVE
SSAU-4124	42165320340000	PROD_OIL	ACTIVE
SSAU-1909	42165320350000	INJ_WAG	ACTIVE
SSAU-1614	42165320360000	INJ_WAG	ACTIVE
SSAU-1611	42165320370000	PROD_OIL	ACTIVE
SSAU-1609	42165320380000	PROD_OIL	ACTIVE
SSAU-1514	42165320390000	PROD_OIL	ACTIVE
SSAU-1411	42165320410000	PROD_OIL	ACTIVE
SSAU-1515	42165320420000	PROD_OIL	ACTIVE
SSAU-1016	42165320430000	PROD_OIL	ACTIVE
SSAU-1013	42165320440000	PROD_OIL	ACTIVE

SSAU-0906	42165320450000	PROD_OIL	ACTIVE
SSAU-1615	42165320460000	PROD_OIL	ACTIVE
SSAU-1613	42165320470000	PROD_OIL	ACTIVE
SSAU-1610	42165320480000	PROD_OIL	TA
SSAU-2226	42165320530000	PROD_OIL	ACTIVE
SSAU-2221	42165320560000	PROD_OIL	ACTIVE
SSAU-1908	42165320570000	PROD_OIL	ACTIVE
SSAU-2222	42165320770000	PROD_OIL	ACTIVE
SSAU-1017	42165320940000	PROD_OIL	ACTIVE
SSAU-4125	42165320950000	PROD_OIL	P & A
SSAU-4127	42165321050000	PROD_OIL	ACTIVE
SSAU-4130	42165321060000	PROD_OIL	ACTIVE
SSAU-4129	42165321070000	PROD_OIL	ACTIVE
SSAU-4128	42165321080000	INJ_WAG	ACTIVE
SSAU-2916	42165321240000	PROD_OIL	ACTIVE
SSAU-2918	42165321270000	PROD_OIL	ACTIVE
SSAU-2917	42165321280000	INJ_WAG	ACTIVE
SSAU-2919	42165321300000	PROD_OIL	ACTIVE
SSAU-3522	42165321320000	PROD_OIL	ACTIVE
SSAU-3527	42165321330000	PROD_OIL	ACTIVE
SSAU-2227	42165321340000	PROD_OIL	INACTIVE
SSAU-3526	42165321350000	INJ_WAG	ACTIVE
SSAU-3525	42165321370000	INJ_WAG	ACTIVE
SSAU-3523	42165321380000	INJ_WAG	ACTIVE
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SSAU-3531	42165321400000	INJ_WAG	ACTIVE
SSAU-3529	42165321410000	PROD_OIL	ACTIVE
SSAU-3407	42165321420000	PROD_OIL	ACTIVE
SSAU-2228	42165322070000	INJ_WAG	ACTIVE
SSAU-2801R	42165325930000	INJ_WAG	ACTIVE
SSAU-3215	42165326730000	PROD_OIL	ACTIVE
SSAU-3121	42165326740000	PROD_OIL	ACTIVE
SSAU-3120	42165326750000	INJ_WAG	ACTIVE
SSAU-2315	42165326760000	INJ_WAG	ACTIVE
SSAU-3216	42165326790000	INJ_WAG	ACTIVE
SSAU-3705	42165327310000	PROD_OIL	ACTIVE
SSAU-3528	42165327340000	PROD_OIL	TA
SSAU-3218	42165327350000	INJ_WAG	ACTIVE
SSAU-2820	42165327410000	PROD_OIL	ACTIVE
SSAU-2920	42165327430000	INJ_WAG	ACTIVE
SSAU-2921	42165327440000	PROD_OIL	P & A

SSAU-3122	42165327510000	PROD_OIL	ACTIVE
SSAU-2818	42165327520000	PROD_OIL	ACTIVE
SSAU-2316	42165327530000	PROD_OIL	ACTIVE
SSAU-3219	42165327540000	INJ_WAG	ACTIVE
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SSAU-2604	42165327560000	INJ_WAG	ACTIVE
SSAU-2814	42165327760000	INJ_WAG	ACTIVE
SSAU-2816	42165327770000	INJ_WAG	ACTIVE
SSAU-2815	42165327780000	PROD_OIL	ACTIVE
SSAU-2506	42165327790000	PROD_OIL	ACTIVE
SSAU-2314	42165327800000	INJ_WAG	ACTIVE
SSAU-2813	42165327960000	PROD_OIL	ACTIVE
SSAU-2507	42165327970000	INJ_WAG	ACTIVE
SSAU-2317	42165327980000	PROD_OIL	P & A
SSAU-3916	42165328250000	PROD_OIL	ACTIVE
SSAU-1019	42165328260000	INJ_WAG	ACTIVE
SSAU-2407	42165328270000	INJ_WAG	ACTIVE
SSAU-1018	42165328280000	PROD_OIL	ACTIVE
SSAU-2714	42165328290000	INJ_WAG	ACTIVE
SSAU-3915	42165328310000	INJ_WAG	ACTIVE
SSAU-2225	42165328620000	PROD_OIL	ACTIVE
SSAU-3917	42165328630000	PROD_OIL	ACTIVE
SSAU-3408	42165328640000	INJ_WAG	ACTIVE
SSAU-2313	42165328650000	INJ_WAG	ACTIVE
SSAU-3533	42165328660000	PROD_OIL	ACTIVE
SSAU-2713	42165328670000	PROD_OIL	ACTIVE
SSAU-4131	42165328680000	PROD_OIL	ACTIVE
SSAU-3911	42165328730000	PROD_OIL	ACTIVE
SSAU-3912	42165328750000	PROD_OIL	P & A
SSAU-4016	42165328760000	PROD_OIL	ACTIVE
SSAU-4323	42165328770000	PROD_OIL	ACTIVE
SSAU-3913	42165328780000	INJ_WAG	ACTIVE
SSAU-4208	42165328800000	INJ_WAG	ACTIVE
SSAU-4017	42165328810000	PROD_OIL	ACTIVE
SSAU-3914	42165328910000	PROD_OIL	INACTIVE
SSAU-4207	42165328920000	PROD_OIL	P & A
SSAU-4206	42165328930000	PROD_OIL	ACTIVE
SSAU-4014	42165329030000	PROD_OIL	ACTIVE
SSAU-4020	42165329040000	PROD_OIL	ACTIVE
SSAU-4013A	42165329070000	INJ_WAG	ACTIVE
SSAU-4909	42165330350000	PROD_OIL	ACTIVE

SSAU-5104	42165330360000	PROD_OIL	ACTIVE
SSAU-5106	42165330670000	INJ_WAG	ACTIVE
SSAU-3201R	42165330680000	PROD_OIL	ACTIVE
SSAU-5206	42165330690000	PROD_OIL	ACTIVE
SSAU-3530	42165330900000	PROD_OIL	ACTIVE
SSAU-5207	42165331060000	INJ_WAG	ACTIVE
SSAU-5107	42165331070000	PROD_OIL	ACTIVE
SSAU-1303R	42165331210000	INJ_WAG	ACTIVE
SSAU-5310	42165331220000	INJ_WAG	ACTIVE
SSAU-5517	42165331230000	INJ_WAG	ACTIVE
SSAU-5105	42165331240000	PROD_OIL	ACTIVE
SSAU-3912R	42165331250000	PROD_OIL	ACTIVE
SSAU-5209	42165331260000	INJ_WAG	ACTIVE
SSAU-5309	42165331310000	PROD_OIL	ACTIVE
SSAU-5518	42165331480000	PROD_OIL	ACTIVE
SSAU-5523	42165331490000	PROD_OIL	ACTIVE
SSAU-5520	42165331500000	PROD_OIL	ACTIVE
SSAU-5524	42165331510000	INJ_WAG	ACTIVE
SSAU-5519	42165331520000	INJ_WAG	ACTIVE
SSAU-5521	42165331530000	PROD_OIL	ACTIVE
SSAU-5210	42165331540000	PROD_OIL	ACTIVE
SSAU-5522	42165331550000	INJ_WAG	ACTIVE
SSAU-5529	42165331910000	PROD_OIL	ACTIVE
SSAU-5406	42165331920000	PROD_OIL	ACTIVE
SSAU-5528	42165331930000	PROD_OIL	ACTIVE
SSAU-5530	42165331940000	PROD_OIL	TA
SSAU-5531	42165331950000	PROD_OIL	ACTIVE
SSAU-5407	42165331960000	INJ_WAG	ACTIVE
SSAU-5409	42165331970000	PROD_OIL	ACTIVE
SSAU-5312	42165331980000	INJ_WAG	ACTIVE
SSAU-5108	42165332090000	PROD_OIL	INACTIVE
SSAU-5311	42165332180000	PROD_OIL	ACTIVE
SSAU-5525	42165332210000	PROD_OIL	ACTIVE
SSAU-5527	42165332220000	PROD_OIL	ACTIVE
SSAU-5408	42165332230000	INJ_WAG	ACTIVE
SSAU-6310	42165332250000	PROD_OIL	ACTIVE
SSAU-5526	42165332260000	INJ_WAG	ACTIVE
SSAU-6309	42165332270000	PROD_OIL	ACTIVE
SSAU-6504	42165332280000	PROD_OIL	ACTIVE
SSAU-6412	42165332290000	PROD_OIL	ACTIVE
SSAU-6409	42165332300000	PROD_OIL	TA

SSAU-6411	42165332310000	PROD_OIL	TA
SSAU-6312	42165332320000	PROD_OIL	ACTIVE
SSAU-6311	42165332350000	PROD_OIL	ACTIVE
SSAU-6213	42165332360000	PROD_OIL	TA
SSAU-5313	42165332410000	INJ_WAG	ACTIVE
SSAU-5405	42165332420000	PROD_OIL	ACTIVE
SSAU-6505	42165332430000	PROD_OIL	INACTIVE
SSAU-1408R	42165333580000	INJ_WAG	ACTIVE
SSAU-6313	42165334080000	PROD_OIL	INACTIVE
SSAU-7203	42165334180000	PROD_OIL	INACTIVE
SSAU-6215	42165334640000	PROD_OIL	TA
SSAU-4301R	42165334810000	INJ_WAG	ACTIVE
SSAU-6410	42165335190000	PROD_OIL	ACTIVE
SSAU-2304R	42165337570000	INJ_WAG	ACTIVE
SSAU-1201R	42165337580000	INJ_WAG	ACTIVE
SSAU-4003R	42165337590000	INJ_WAG	ACTIVE
SSAU-3512R	42165339320000	PROD_OIL	ACTIVE
SSAU-1402R	42165339340000	INJ_WAG	ACTIVE
SSAU-2903R	42165339350000	PROD_OIL	ACTIVE
SSAU-4005R	42165339360000	INJ_WAG	ACTIVE
SSAU-4203R	42165339380000	INJ_WAG	ACTIVE
SSAU-1311	42165340630000	PROD_OIL	ACTIVE
SSAU-1105	42165340860000	PROD_OIL	TA
SSAU-7607	42165341760000	PROD_OIL	P & A
SSAU-1205	42165341930000	PROD_OIL	ACTIVE
SSAU-1312	42165341940000	PROD_OIL	ACTIVE
SSAU-1517	42165342290000	PROD_OIL	ACTIVE
SSAU-1104	42165342300000	PROD_OIL	ACTIVE
SSAU-901IR	42165342320000	INJ_WAG	ACTIVE
SSAU-3803R	42165346470000	INJ_WAG	ACTIVE
SSAU-0903R	42165346480000	INJ_WAG	ACTIVE
SSAU-2229	42165346490000	PROD_OIL	ACTIVE
SSAU-1518	42165346500000	PROD_OIL	ACTIVE
SSAU-2922	42165348760000	PROD_OIL	ACTIVE
SSAU-5505R	42165349450000	PROD_OIL	ACTIVE
SSAU-5515R	42165350450000	PROD_OIL	INACTIVE
SSAU-1102R	42165352730000	INJ_WAG	ACTIVE
SSAU-4207R	42165360360000	PROD_OIL	ACTIVE
SSAU-3506R	42165361810000	PROD_OIL	ACTIVE
SSAU-3105B	42165361820000	PROD_OIL	ACTIVE
SSAU-4201R	42165362070000	INJ_WAG	ACTIVE

SSAU-5512R	42165364470000	PROD_OIL	ACTIVE
SSAU-3903R	42165364550000	PROD_OIL	ACTIVE
SSAU-2923	42165368650000	PROD_OIL	ACTIVE
SSAU-3123	42165369140000	PROD_OIL	P & A
SSAU-4314R	42165369390000	PROD_OIL	ACTIVE
SSAU-3123R	42165369440000	PROD_OIL	ACTIVE
SSAU-5503R	42165369580000	PROD_OIL	ACTIVE
SSAU-3515R	42165369810000	PROD_OIL	ACTIVE
SSAU-4125R	42165369820000	INJ_WAG	ACTIVE
SSAU-3910R	42165374780000	INJ_WAG	ACTIVE
SSAU-3528R	42165374790000	INJ_WAG	ACTIVE
SSAU-3534	42165374800000	PROD_OIL	ACTIVE
SSAU-4322R	42165375550000	PROD_OIL	ACTIVE
SSAU-4209	42165377730000	PROD_OIL	ACTIVE
SSAU-3104R	42165377800000	INJ_WAG	ACTIVE
SSAU-3520R	42165377850000	PROD_OIL	ACTIVE
SSAU-4118R	42165378080000	PROD_OIL	ACTIVE
SSAU-6222	42165379860000	INJ_H2O	ACTIVE
SSAU-6219	42165379970000	PROD_OIL	ACTIVE
SSAU-6217	42165380060000	PROD_OIL	ACTIVE
SSAU-6225	42165380140000	PROD_OIL	TA
SSAU-6220	42165380180000	PROD_OIL	ACTIVE
SSAU-6221	42165380230000	PROD_OIL	ACTIVE
SSAU-6223	42165380280000	PROD_OIL	TA
SSAU-6224	42165380310000	PROD_OIL	ACTIVE
SSAU-1910	42165380730000	PROD_OIL	ACTIVE
SSAU-2921R	42165382020000	PROD_OIL	ACTIVE
SSAU-1505R	42165386280000	INJ_WAG	ACTIVE
SSAU-2317R	42165386290000	PROD_OIL	ACTIVE
SSAU-4113R	42165386310000	PROD_OIL	ACTIVE
SSAU-2505R	42165386320000	PROD_OIL	ACTIVE
SSAU-3301R	42165386710000	INJ_WAG	ACTIVE
SSAU-3107R	42165386730000	INJ_WAG	ACTIVE
SSAU-3703R	42165386740000	PROD_OIL	ACTIVE
SSAU-4021S	42165386760000	PROD_OIL	ACTIVE

12.2 Regulatory References

Regulations cited in this plan:

1. 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

2. Oil and Gas Procedure Manual:
https://www.rrc.texas.gov/oil-and-gas/publications-and-notices/manuals/oil-and-gas-procedure-manual/

Request for Additional Information: Seminole San Andres Unit
July 6, 2023

Instructions: Please enter responses into this table and make corresponding revisions to the MRV Plan as necessary. Any long responses, references, or supplemental information may be attached to the end of the table as an appendix. This table may be uploaded to the Electronic Greenhouse Gas Reporting Tool (e-GGRT) in addition to any MRV Plan resubmissions.

No.	MRV Plan		EPA Questions	Responses
	Section	Page		
1.	10.2.2	35	Section 3.3 states that, "The total amount of CO_2 produced is measured using meters labeled "M4" and "M3" on Figure 5." Based on Figure 5, the meters are located at the outlet of the separation facilities. However, Section 10.1.2 states that, "The quarterly flow rate of the produced gas is measured at the flow meters located at the SGPP inlet." Flow meters used to measure CO_2 produced must be located at the outlet of the separation facilities, not the inlet. Please ensure that all references to flow meter locations are consistent throughout the MRV plan and in accordance with the necessary regulations. For reference, see https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-98/subpart-RR#p-98.444(c).	The text of section 10.1.2 has been corrected to reference meters located at the outlets of the separation facility. All references to meter locations have been confirmed.

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

May 2023

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1. Introduction

OXY USA INC, a subsidiary of Occidental (Oxy) operates a CO_2-Enhanced Oil Recovery (CO_2-EOR) project in the Seminole San Andres Unit (SSAU). This Monitoring, Reporting, and Verification (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 CO_2 sequestered at the SSAU during a specified period of injection.

2. Facility Information

2.1 Reporter Number

XXXX –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 in-service wells in the SSAU (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 SSAU are currently classified as UIC Class II wells.

2.3 Existing Wells

Wells in the SSAU are identified by name and number, API number, type, and status. The list of wells as of November 2022 is included in Section 12.1. Any changes in these wells or additional wells will be indicated in the annual monitoring report.

3. Project Description

This project takes place in the SSAU, an oilfield located in West Texas that was first produced in 1941. CO_2 flooding was initiated in 1983 and the injection plan calls for an additional total of approximately 174 million metric tons of CO_2 to be stored over the remaining lifetime of the project. The field is well characterized and Oxy determined that it 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 1.0 or very close to it. Oxy constructed a history-matched reservoir simulation of the injection at SSAU.

3.1 Project Characteristics

The Seminole San Andres field was discovered in 1936 and started producing in 1941. The field was unitized in 1968, and waterflood was initiated in 1969. CO_2 flooding was initiated in 1983. A long-term forecast for SSAU was developed using the reservoir modeling approaches described in Section 3.4, including storage of an additional total of approximately 174 million metric tons of CO_2 over the remaining life of the project. Figure 1 shown below, is a graph of the quantity of CO_2 injected, produced, and stored between 1983 and 2021 (solid lines) and a forecast of the CO_2 that will be injected, produced, and stored between 2022 and 2055 (dashed lines) in the SSAU. Oxy has injected 224 million metric tons (MMT) of CO_2 into the SSAU through the end of 2021. Of

that amount, 109 MMT CO_2 was produced and reinjected, and 115 MMT CO_2 was stored. Oxy forecasts CO_2 injection of 532 MMT from the year 2022 until the year 2055, which is currently projected to be the end of the project. Of that amount, 358 MMT is forecast to be produced and 174 MMT will be stored.

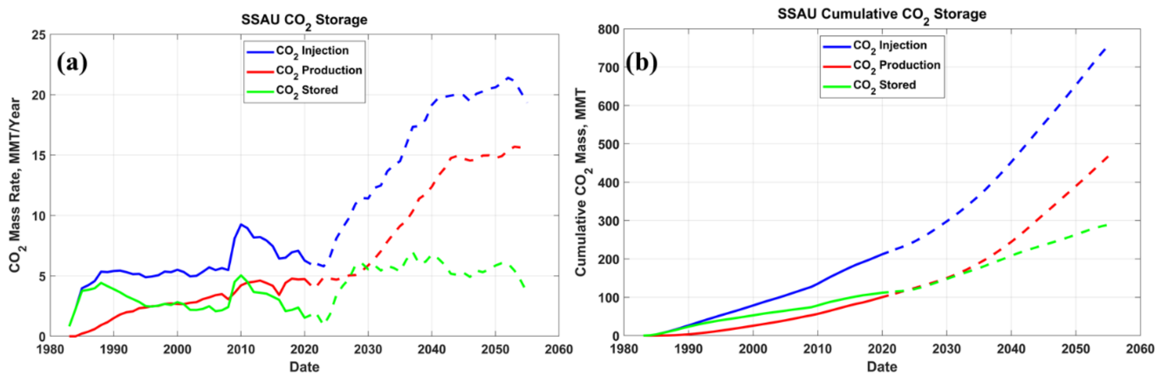

Figure 1—SSAU Historic and Forecast CO_2 Injection, Production, and Storage (a) Rate (MMT/Year), (b) Cumulative Mass (MMT)

3.2 Environmental Setting

The SSAU is located in the northeast portion of the Central Basin Platform in West Texas (Figure 2).

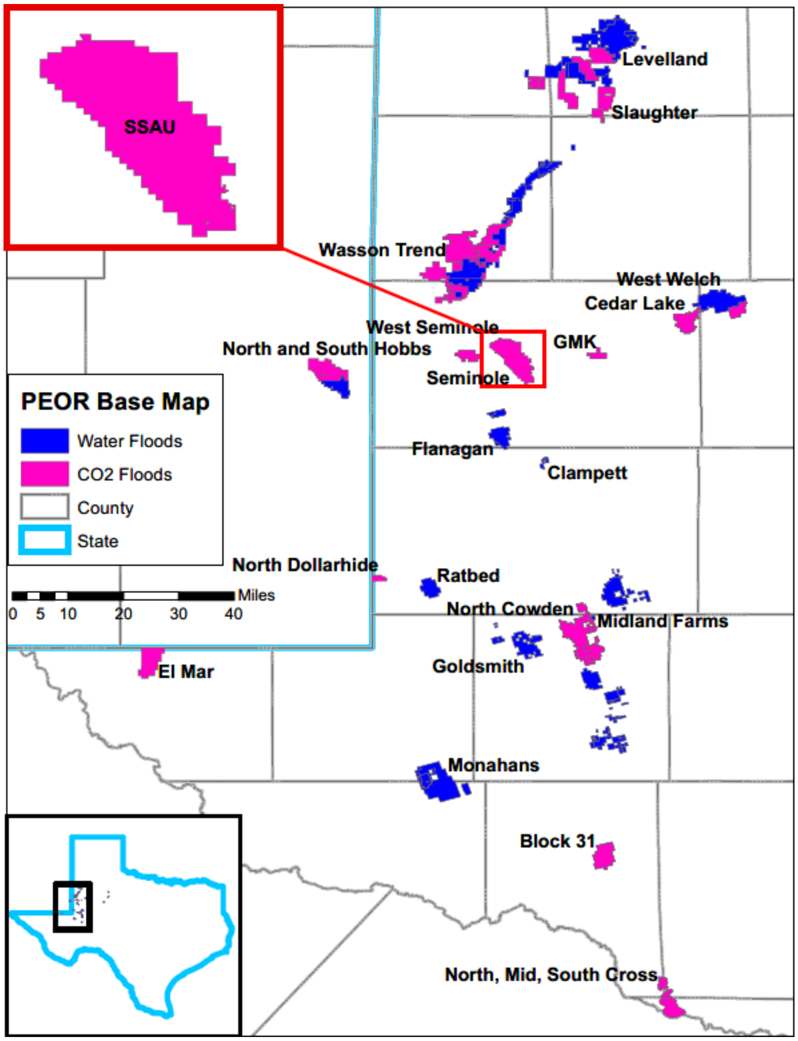

Figure 2—Location of SSAU in West Texas

Figure 3 is a schematic of the SSAU storage complex. The SSAU sequestration zone ranges between 1,165 and 1,850 ft in thickness with an average thickness of 1,600 ft. This productive interval, or reservoir, is within the San Andres Formation and 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.

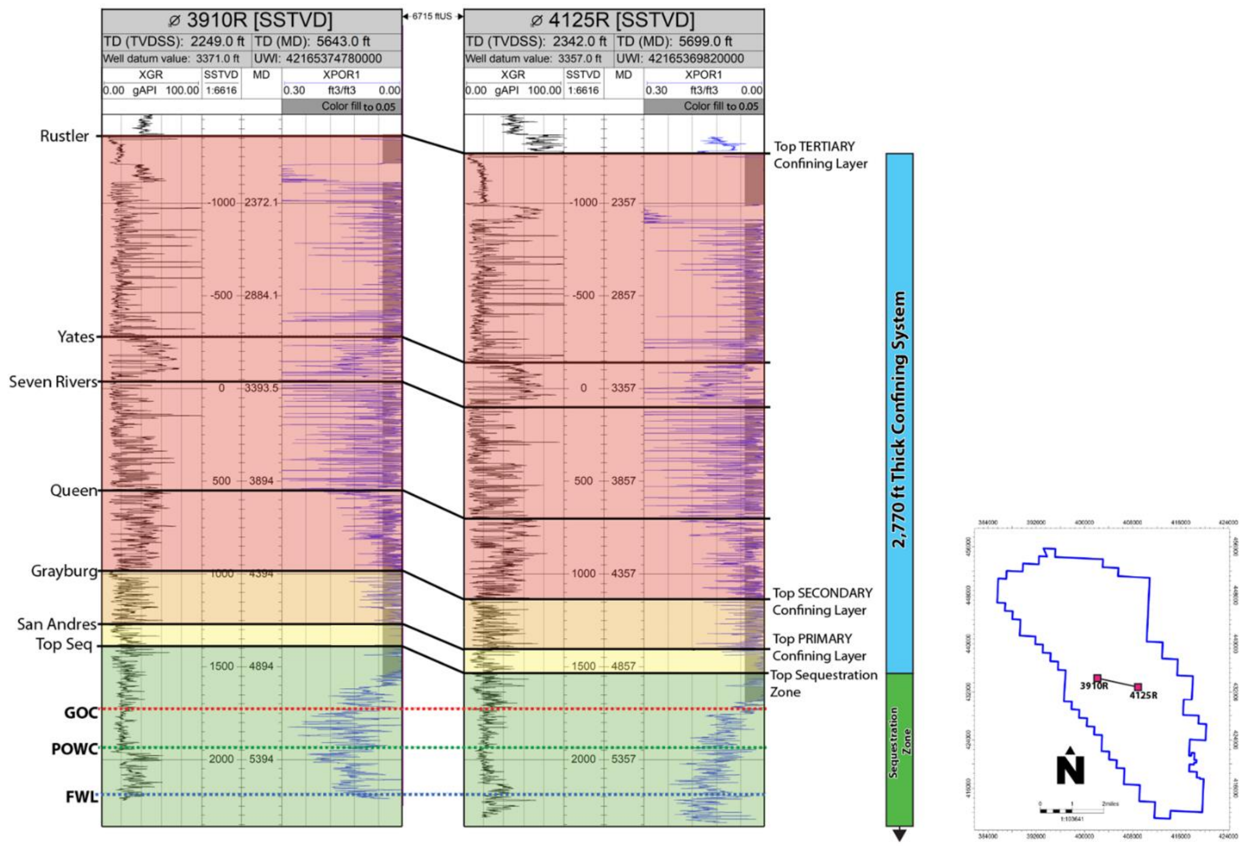

Figure 3—SSAU Geologic Column. Notes: TD = Total Depth, TVDSS or SSTVD = Total Vertical Depth Subsea, MD = Measured Depth, UWI = Unique Well Identification number, XGR = Gamma Ray log, XPOR1 = Porosity log, GOC = Gas Oil Contact, POWC = Producing Oil Water Contact, FWL = Free Water Level.

Figure 3 shows the overlying confining system, which consists of non-porous anhydritic strata that are ~2,770 ft thick and are comprised of three sub-zones:

- A ~95 ft thick primary confining layer between the top of sequestration zone and top of San Andres Formation;
- A ~200 ft thick secondary confining layer between San Andres Formation and Grayburg Formation; and,
- A ~2,350 ft thick tertiary confining layer from the Grayburg Formation to the Rustler Formation.

There are numerous relatively thin layers that provide additional secondary containment between the sequestration zone and freshwater aquifers found at a depth of 250 feet. These layers are comprised of siltstones, shales, salts, and anhydrite sequences with little to no porosity or permeability.

SSAU is located in the Permian Basin on the northeast portion of the Central Basin Platform in West Texas. SSAU is draped over a fault-bounded doubly plunging anticline that tips out in Devonian strata where several N-NW trending seismically resolvable faults have been identified and mapped. Faults are situated southwest of the structural crest, with a maximum offset of 1,800 ft within Devonian strata and tip out approximately 1,700 ft below the SSAU sequestration zone. Oxy extensively analyzed seismic data acquired over the SSAU to assess potential leakage pathways and basement-rooted faults. Oxy determined that seismic attributes, such as coherence, do not reveal linear discontinuities beyond those currently mapped. Likewise, Oxy found that downhole measurements from profile logs and micro-resistivity imaging tools show no indication of conductive faults or fractures. Pressure-based interference tests and simulation-based history matching also indicate that reservoir behavior has not been modified by faults and fractures. In summary, Oxy determined that multiple fault/fracture characterization tools indicate the sequestration zone and confining system are free of faults and fractures that could act as leakage pathways.

SSAU is a dome structure that includes the highest elevations within the area. The elevated area forms a natural trap for oil and gas that migrated upward from deeper source rocks over millions of years. Once trapped in these higher elevations, the oil and gas remained in place. In the case of SSAU, this oil and gas has been trapped in the reservoir for 50 to 100 million years. Over time, buoyant fluids, including CO_2, rose vertically until reaching the highest elevation of the structure. Figure 4 shows the Top San Andres pay interval structure. The colors in the structure map in Figure 4 indicate the subsurface elevation, with red illustrating a higher or shallower level and dark blue illustrating a lower or deeper level.

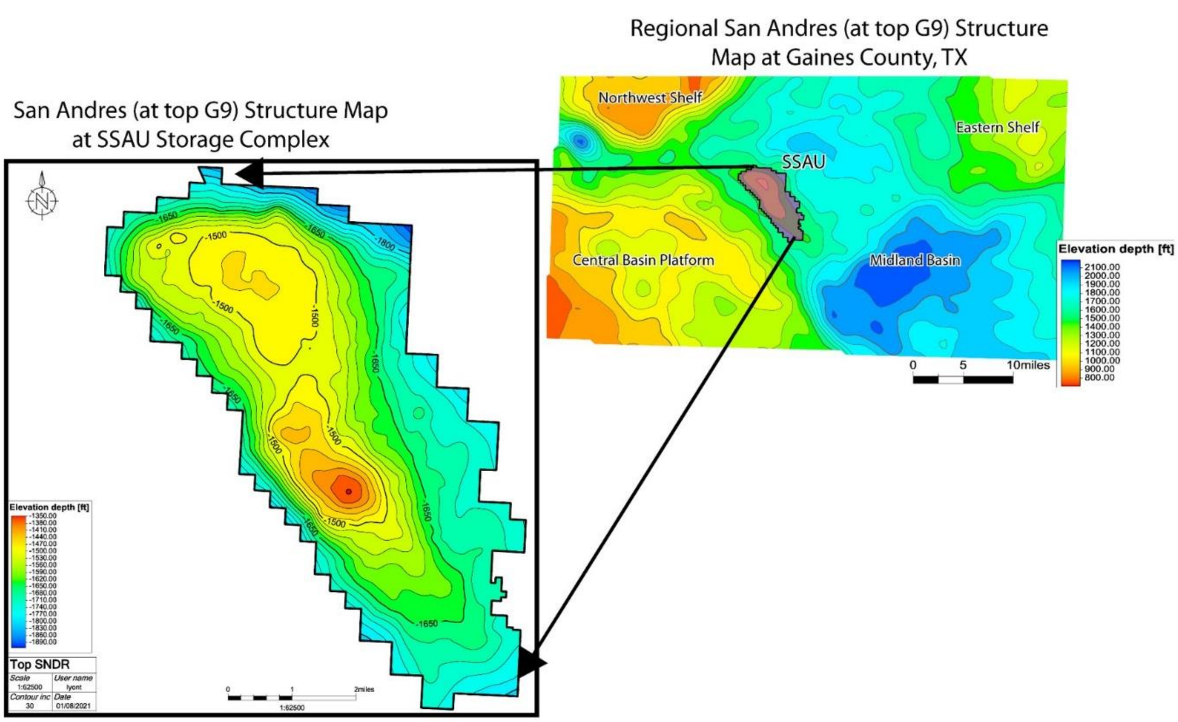

Figure 4—Local Area Structure on Top of San Andres. Note: Top SNDR = Top San Andres

Because of buoyancy differences between oil, water and gas phases, the gas column at SSAU sits above the oil. Water, being the least buoyant of the three fluid phases, is found below the oil. At the time of its discovery, natural gas was trapped at the structural high points of SSAU, 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 Formation. Gas is buoyant and highly mobile. If it could escape SSAU naturally, through faults or fractures, it would have done so over the millennia. Below the gas cap is an oil accumulation called the oil zone. There are no distillable hydrocarbons below the oil zone.

Once the CO_2 flood is complete and injection ceases, the remaining mobile CO_2 will rise slowly upward, driven by buoyancy forces and will be trapped by the confining system. There is more than enough pore space to sequester the planned CO_2 injection. The amount of CO_2 injected will not exceed the reservoir's secure storage capacity; consequently, there is negligible risk that CO_2 could migrate to other reservoirs in the Central Basin Platform. The total reservoir pore volume is calculated to be 5,816 million reservoir barrels (MMRB) from the top of the reservoir down to the base of the oil zone. This equals the volume of rock multiplied by porosity. Table 1 shows the conversion of this amount of pore space into an estimated maximum mass of CO_2 storage of approximately 509 MMT. The total stored CO_2 from previous EOR and the planned forecast injection will fill approximately 57% of the total calculated storage capacity.

Table 1—Calculation of Maximum CO_2 Storage Capacity (MMT) at SSAU

Top of Pay to Free Water Level (2,175 ft subsea)	
Variables	SSAU Outline
Pore Volume (MMRB)	5,816
B_{CO2}	0.41
S_{wirr}	0.18
S_{orCO2} (volume weighted)	0.14
Max CO_2 Billion Cubic Feet (Bcf)	9,646
Max CO_2 (MMT)	509

$$\text{Max } CO_2 = \text{Pore Volume (RB)} * (1 - S_{wirr} - S_{orCO2}) / B_{CO2}$$

Where:

Max CO_2 = maximum CO_2 storage capacity, MMT
Pore Volume (RB) = volume of the rock formation in Reservoir Barrels
B_{CO2} = formation volume factor for CO_2
S_{wirr} = irreducible water saturation
S_{orCO2} = irreducible oil saturation

Oxy has a high degree of confidence that stored CO_2 will be contained securely within the reservoir because: 1) SSAU is located at the highest subsurface elevations in the area; 2) the confining zone has proved competent over millions of years and with current CO_2 flooding; and, 3) SSAU has ample storage capacity.

3.3 Description of CO_2-EOR Project Facilities and the Injection Process

Figure 5 shows a simplified process flow diagram (PFD) of the project facilities and equipment in the SSAU. CO_2 is delivered to SSAU via the Permian Basin CO_2 pipeline network from several different sources.

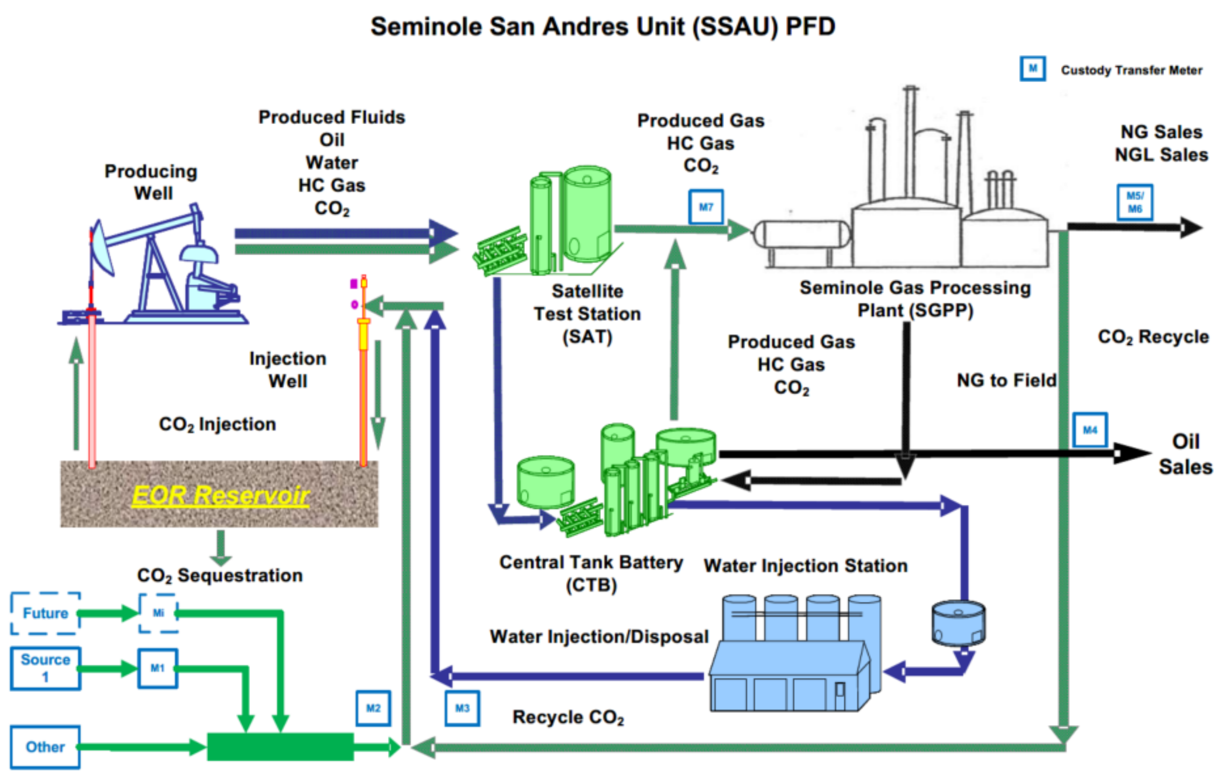

Figure 5—SSAU Process Flow Diagram. Notes: HC = Hydrocarbon, NG = Natural Gas, NGL = Natural Gas Liquids

Once CO_2 enters SSAU, there are three main processes involved in EOR operations:

1. **CO_2 Distribution and Injection.** The mass of CO_2 received at SSAU is metered and calculated through the custody transfer meter located at the pipeline delivery point, as indicated by the box labeled "M2" in the bottom left of Figure 5. The mass of CO_2 received is combined with recycled CO_2 from the Seminole Gas Processing Plant (SGPP), denoted by box labeled "M3," and distributed to the CO_2 trunklines for injection into the injection wells according to the pre-programmed injection plan for each well pattern, which alternates between water and CO_2 injection. This is an EOR project, and reservoir pressure must be maintained above the minimum miscibility pressure (MMP). Therefore, injection pressure is maintained at a level that is sufficiently high to allow injectants to enter the reservoir, but below the formation parting pressure (FPP).

2. **Produced Fluids Handling.** Produced fluids from the production wells are a mixture of oil, hydrocarbon gas, water, CO_2, and trace amounts of other constituents in the field including nitrogen and hydrogen. Fluids are gathered from producer wells and sent to

satellite test stations (SAT) for separation into a gas/CO_2 mix and a produced fluids mix of water, oil, gas, and CO_2. The gas/CO_2 mix, which is composed primarily of hydrocarbons and CO_2, is sent to the SGPP for CO_2 separation, dehydration, sweetening, and compression before reinjection into the reservoir. The mix of water, oil, gas, and CO_2 is sent to the central tank battery (CTB) where water is separated for reinjection or disposal; oil is separated for sale and metered through a custody transfer meter, and then moved into the pipeline; and, the remaining gas/CO_2 mix is combined with gas/CO_2 separated from the produced fluids in the SAT. The total amount of CO_2 produced is measured using meters labeled "M4" and "M3" on Figure 5.

3. **Water Treatment and Injection.** Water is recovered from the CTB for reuse and forwarded to the water injection station for treatment and reinjection using a closed loop process or for disposal.

3.3.1 Wells in the SSAU

The 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 Oil and Gas Procedure Manual (see Appendix 12.2). 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 underground sources of drinking water 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 where they are encountered into other strata, or into subsurface and surface waters;
- A completion report for each well that includes an electric log (e.g., a density, sonic, or resistivity) 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 and the location and setting of plugs; and,
- Injection well operators must identify an Area of Review (AoR), use materials and equipment compatible with the injection fluids, test, and maintain well records.

Table 2 provides a well count by type and status as of November 2022. All these wells are in material compliance with TRRC rules.

Table 2—SSAU Well Penetrations by Type and Status (as November 2022)

Row Labels	**ACTIVE**	**INACTIVE**	**P&A**	**SHUT-IN**	**TA**	**Grand Total**
INJ_H2O	27	4	16	0	10	57
INJ_WAG	190	3	11	4	2	210
PROD_OIL	306	21	60	0	30	417
Grand Total	**523**	**28**	**87**	**4**	**42**	**684**

Notes: INJ_H2O = water injector, INJ_WAG = Water Alternating Gas Injector, PROD_OIL = Oil producer, P&A = Plugged and Abandoned, TA = Temporarily Abandoned

As indicated in Figure 6, wells are distributed across the SSAU. The well patterns currently undergoing CO_2 flooding are outlined in the black box. During the life of the project the well count and status is projected to change as the SSAU injection plan is implemented. Oxy may seek TRRC approval to drill new wells, recomplete existing wells, or plug and abandon existing wells. Such changes will be included in the annual monitoring report.

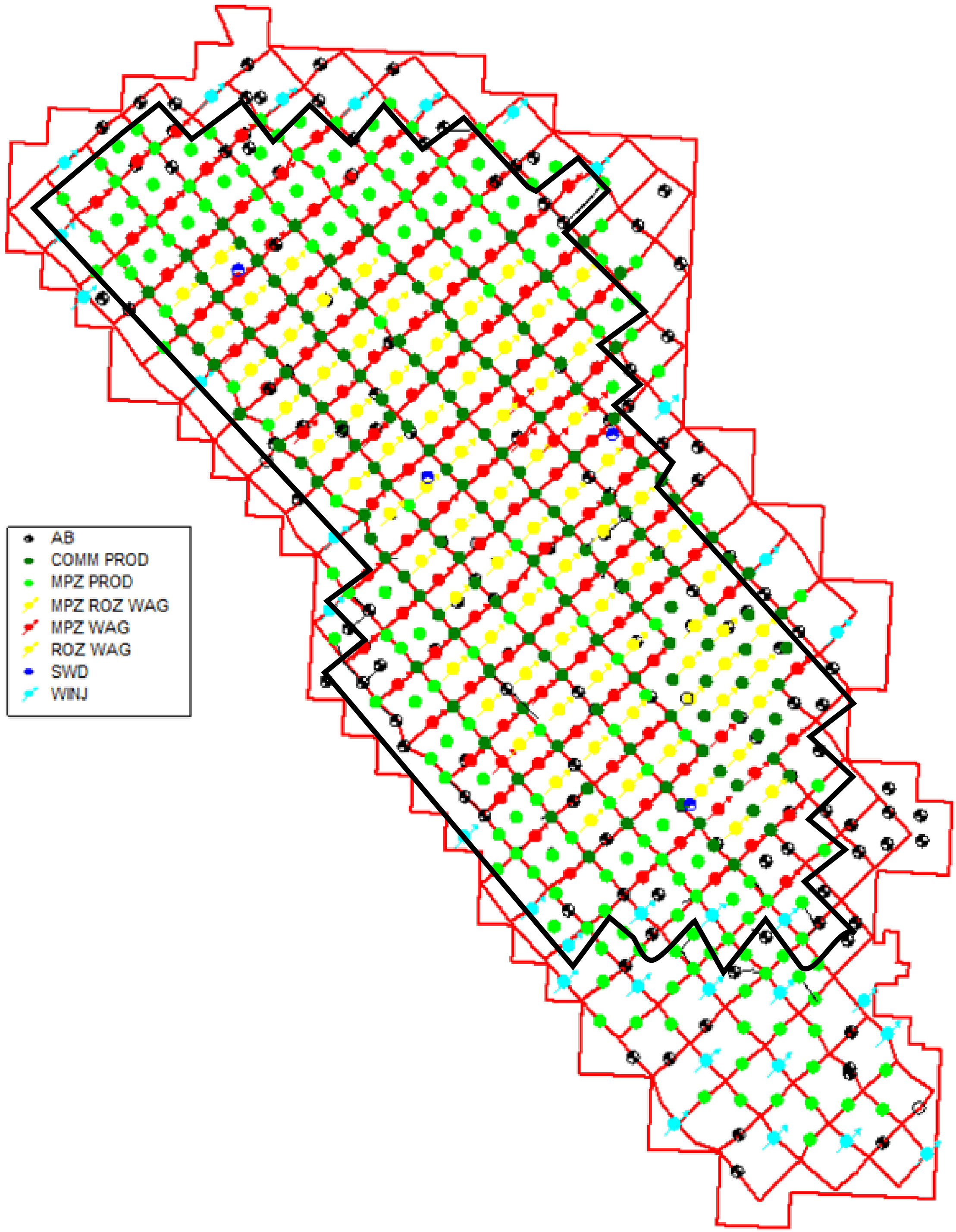

Figure 6—SSAU Wells and Injection Patterns. Notes: AB = Abandoned, COMM PROD = Commingled Producer, MPZ PROD = Main Pay Zone Producer, MPZ ROZ WAG = Main Pay Zone Residual Oil Zone Water Alternating Gas, MPZ WAG = Main Pay Zone Water Alternating Gas, ROZ WAG = Residual Oil Zone Water Alternating Gas, SWD = Saltwater Disposal, WINJ = Water Injector

SSAU CO_2 EOR operations are designed to avoid conditions that could damage the reservoir and create a potential leakage pathway. Oxy manages reservoir pressure by maintaining an injection-to-withdrawal ratio (IWR)[1] of approximately 1.0. To do this, 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 oilfield.

Oxy maintains injection pressure below the FPP, which is measured using step-rate tests.

3.4 Reservoir Modeling

A history-matched reservoir model of the current and forecast SSAU CO_2 injection plan has been constructed using tNavigator, which is a commercially available reservoir simulation software program. The model simulates the recovery mechanism in which CO_2 is miscible with the hydrocarbon phase in the reservoir.

The model was created to:

- Demonstrate that the storage complex has, at the minimum, the capacity to contain the planned mass of injected CO_2; and
- Track injected CO_2, identify how and where CO_2 is trapped in the SSAU, and monitor sequestration mass and distribution.

The reservoir model utilizes four types of data:

1. Site Characteristics as described in the SSAU geomodel,
2. Initial reservoir conditions and fluid property data,
3. Capillary pressure data, and
4. Well data.

The static geomodel that serves as the foundation for the dynamic simulation model used data from digital open- and cased-hole logs of 684 wells within the SSAU boundary to correlate formation tops. Oxy developed a sequence stratigraphic framework for SSAU based on core descriptions and outcrop analogs. Oxy selected the sequence stratigraphic correlations of flow units at the base of mud-dominated flooding surfaces in core, linked to well logs, and extrapolated throughout the field.

The dynamic simulation model is a four-component model consisting of water, oil, reservoir gas, and injected CO_2. It is an extension of the black oil model that enables the modeling of various recovery mechanisms, including miscible injection of CO_2, which is justified because the reservoir under study is above MMP. Oxy used the total hydrocarbon and solvent (CO_2) saturation to calculate relative permeability to water. Oxy then used the solvent and oil relative permeability to

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[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.

calculate multipliers from a look-up table. Oxy used the Todd-Longstaff[2] model to calculate the effective viscosity and density of the hydrocarbon and solvent phases.

Oxy conducted history matching on the dynamic simulation model to adjust input parameters within the range of data uncertainties until the actual reservoir performance was closely reproduced in the model. Using this process, Oxy obtained an 84-year history match. 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 four graphs in Figure 7 present the history match results of oil rate, water rate, liquid rate, and gas rate, showing that the reservoir model provides an excellent match to actual historical data. Figure 8 shows the matches of water and CO_2 injection.

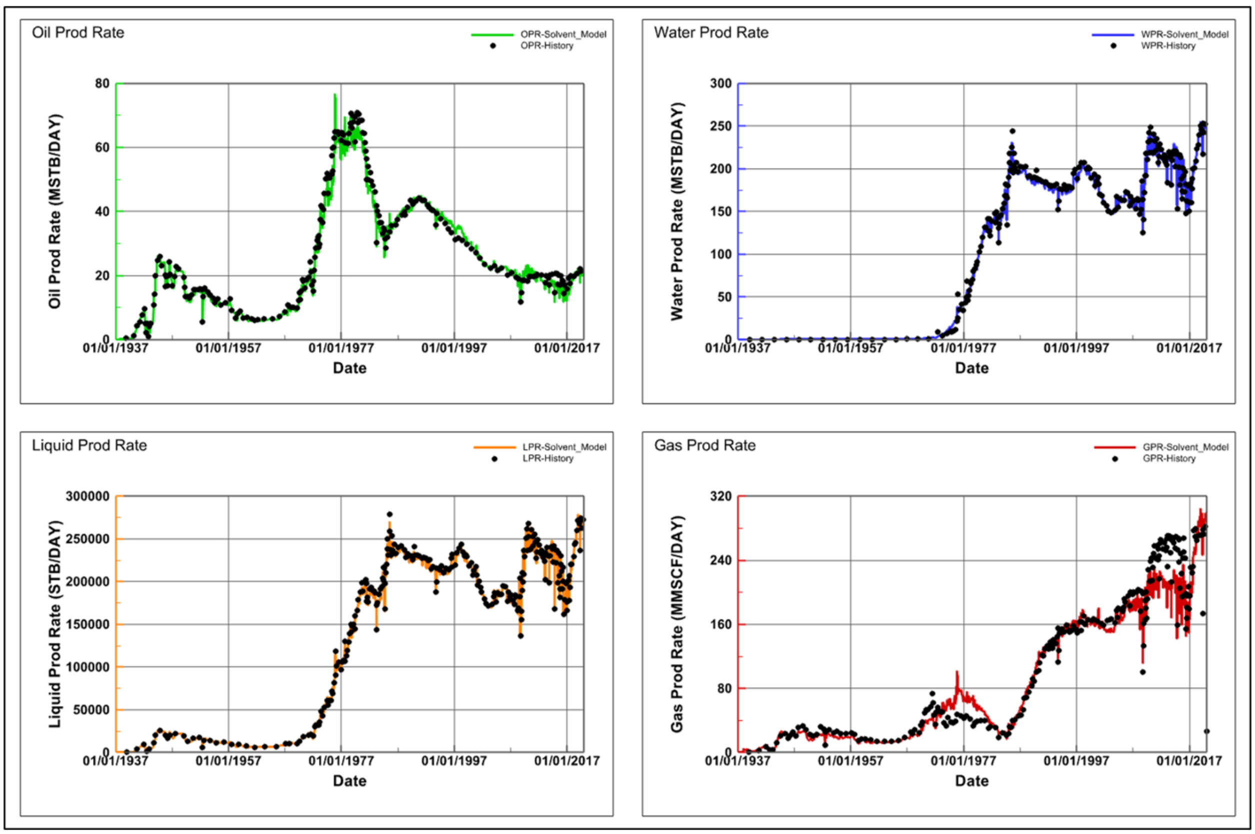

Figure 7—Four Parameters of History-Matched Modeling in the SSAU Reservoir Model. Notes: OPR = Oil Production Rate; WPR = Water Production Rate; MSTB/Day = Thousand Stock Tank Barrels per Day, MMSCF/Day = Million Standard Cubic Feet per Day

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).

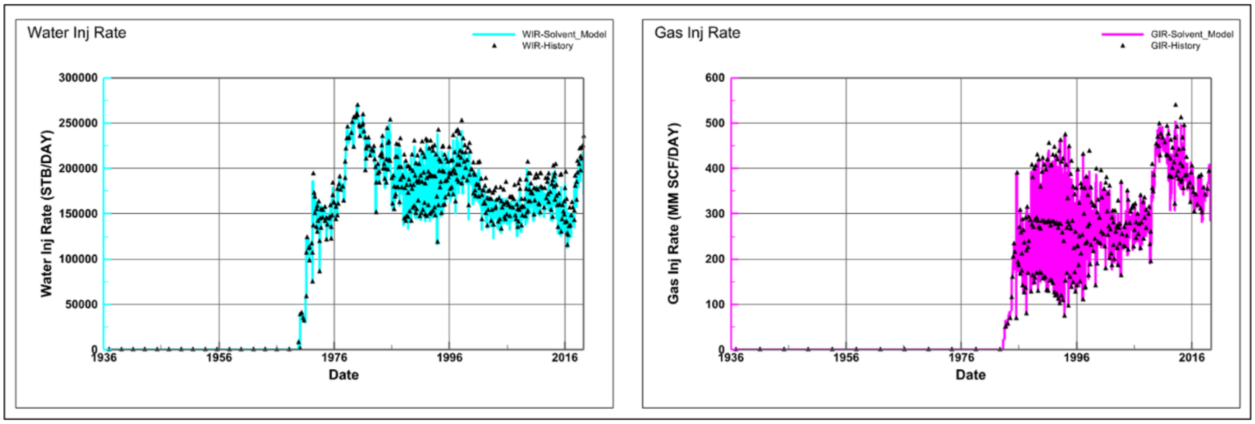

Figure 8—Plots of Injection History Match in the SSAU Reservoir Model. Note: WIR = Water Injection Rate; GIR = Gas Injection Rate

Oxy used the SSAU reservoir model to evaluate the plume of CO_2 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's CO_2 storage performance. The model forecast showed that CO_2 is contained in the reservoir within the boundaries of SSAU.

4. Delineation of Monitoring Area and Timeframes

4.1 Active Monitoring Area

The Active Monitoring Area (AMA) is shown in Figure 9. It is the SSAU plus the required ½-mile buffer. 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).

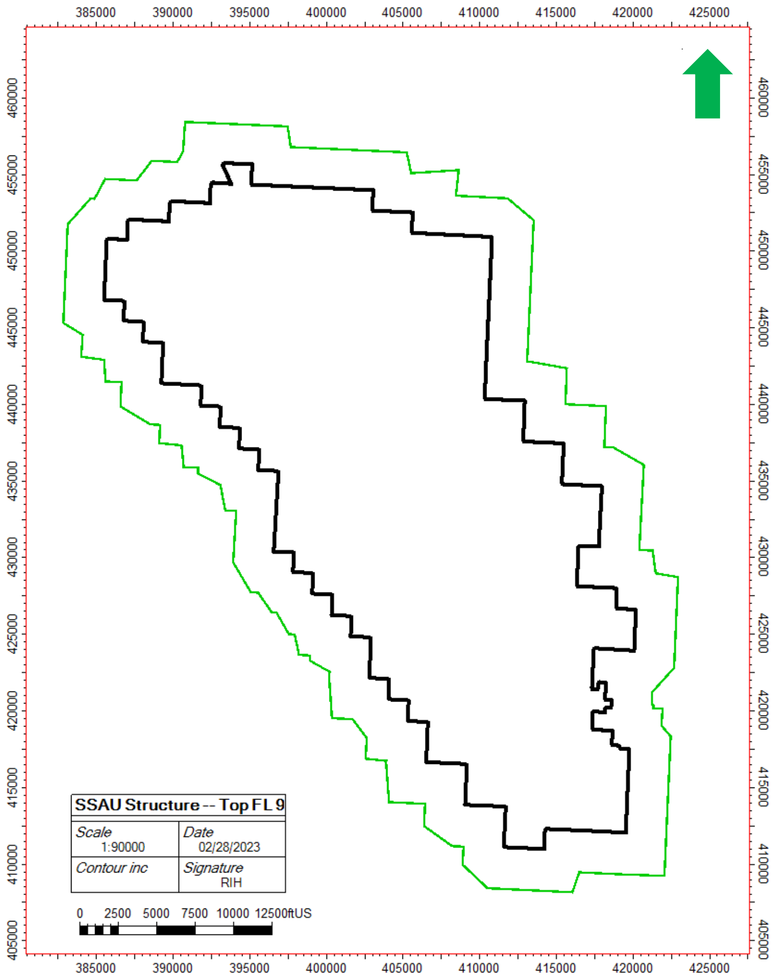

Figure 9—SSAU Unit Boundary with the ½ mile buffer boundary (green)

The AMA determination is supported by project design and site geology as follows:

- Oxy operates injector and producer wells throughout the SSAU as indicated in Figure 6.
- CO_2 injected into the SSAU remains contained within the SSAU because of Oxy's fluid and pressure management practices, i.e., the maintained IWR of 1.0 is consistent with stable reservoir pressure. Managed lease line injection and production wells are used to retain fluids, and operational results confirm that the injected CO_2 is retained within the SSAU.
- The SSAU is a structural high within the formation, therefore CO_2 will migrate updip within the SSAU to the structurally highest position and be retained by the geologic confining unit. CO_2 will not migrate downdip.

4.2 Maximum Monitoring Area

The Maximum Monitoring Area (MMA) is the SSAU plus the required ½-mile buffer (see Figure 9). The maximum extent of CO_2 after the CO_2 plume has stabilized will be contained within the SSAU, therefore the boundary of SSAU plus ½ mile buffer is consistent with the definition in 40 CFR 98.449. After operations cease, the CO_2 plume is projected to remain within the SSAU due to the factors described in Section 3.2 (presence of a structural trap, competent confining zone that has sealed for millions of years, and sufficient pore space), and use of IWR of approximately 1.0. The reservoir model shows that by the end of CO_2 injection, average reservoir pressure will be approximately 2,790 psi. Once injection ceases, reservoir pressure is predicted to stabilize within one year. Over time, reservoir pressure is expected to decline 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.

4.3 Monitoring Timeframes

The primary purpose for injecting CO_2 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 CO_2 in the SSAU. The specified period will be shorter than the period of production from the SSAU.

At the conclusion of the specified period, a request for discontinuation of reporting will be submitted with a demonstration that current monitoring and model(s) show that the cumulative mass of CO_2 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 SSAU is collected for use in reservoir modeling and operations management. Reservoir pressure is not forecast to change appreciably because the IWR will be maintained at approximately 1.0. The reservoir model shows that by the end of CO_2 injection, average reservoir pressure will be approximately 2,790 psi. Once injection ceases, reservoir pressure is predicted to stabilize within one year. Over time, reservoir pressure is expected to decline 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.

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

In the 84 years since the SSAU oilfield 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 CO_2 to the surface, including:

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

1. Existing Wellbores,
2. Faults and Fractures,
3. Natural and Induced Seismic Activity,
4. Previous Operations,
5. Pipeline/Surface Equipment,
6. Lateral Migration Outside the SSAU,
7. Drilling Through the CO_2 Area, and
8. 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 CO_2 flooding, an extensive review of all SSAU penetrations was completed to determine the need for any corrective action. That analysis showed that all penetrations have either been adequately plugged and abandoned or, if still in use, do not require corrective action. All wells Oxy constructed and operates in the SSAU are in compliance with TRRC rules.

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

- CO_2 flood beam-pumped wells,
- Electrical submersible pump (ESP) producer wells,
- Naturally flowing producer wells,
- Hydraulic jet pump producer wells,
- CO_2 WAG injector wells, and
- Water injectors.

A risk assessment undertaken for SSAU classified all risks associated with the subsurface as low risk, i.e., less than 1% likelihood to occur and having a consequence that is insubstantial, which is less than 1% of injected volume during the duration of the event. The risks were classified as low risk because the SSAU geology is well suited to CO_2 sequestration with an extensive confining zone that is free of fractures and faults that could be potential conduits for CO_2 migration. The low risk is supported by the results of the reservoir model, which shows that stored CO_2 is not predicted to leave the SSAU boundary. Any risks are further mitigated because the SSAU is operated in a manner that maintains, monitors, and documents the integrity of the reservoir.

The risk of well leakage is mitigated through:

- Adhering to regulatory requirements for well drilling and testing;
- Implementing best practices Oxy has developed through its extensive operating experience;
- Monitoring injection and production performance, wellbores, and the surface; and,

- Maintaining surface and subsurface equipment.

Continual and routine monitoring of the wellbores and site operations will be used to detect leaks or other potential well problems, as follows, and as discussed in Section 6.1.5 below:

- Pressure in injection wells is monitored on a continual basis. The injection plans for each pattern are programmed into the injection WAG skids to govern the rate, pressure, and duration of either water or CO_2 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 an 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 CO_2 EOR projects, is that such leakage is very rare, and there have been no incidents of fluid migration out of the intended zone at SSAU.
- Production well performance is monitored using the production well tests, when produced fluids are gathered and sent to a 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 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 CO_2 flooding efficiency is optimized. Production well performance that does not meet planned performance is investigated and any identified issues are addressed. Leakage to the outside of production wells is not considered a major risk because reduced pressure in the casing will prevent leakage outside the wellbore. Further, the personal H_2S monitors are designed to detect the presence of leaked fluids around production wells during well inspections.
- Field inspections are conducted on a routine basis by field personnel. CO_2 leaking through an orifice is cold and leads to formation of bright white clouds and ice that are easily spotted. All field personnel are trained to identify leaking CO_2 and other potential problems at wellbores and in the field. Any CO_2 Surface Leakage detected will be documented and reported and quantified.

Based on ongoing monitoring activities and review of the potential leakage risks posed by wellbores, Oxy concludes that the risk of CO_2 Surface Leakage through wellbores is being mitigated by continuous monitoring and by promptly responding to any detected problems as they arise. Any mass of CO_2 Surface Leakage that occurs will be quantified.

5.2 Faults and Fractures

After reviewing geologic and seismic data, Oxy concluded that there are no known faults or fractures that transect the San Andres Formation in the project area. As a result, there is no risk of CO_2 Surface Leakage due to known fractures or faults.

Oxy manages injections patterns to ensure that the injection pressure does not exceed formation parting pressure (FPP) and does not induce faults of fractures. Oxy routinely measures and updates

FPP and reservoir pressure. Oxy also maintains an IWR at or near 1.0. These practices mitigate the potential for CO_2 injection to induce faults or fractures. As a safeguard, WAG skids are continuously monitored and equipped with automatic shutoff controls should injection pressures exceed programmed settings.

5.3 Natural or Induced Seismicity

After reviewing the literature and actual operating experience, Oxy concluded that there is no direct evidence that natural seismic activity poses a significant risk for loss of CO_2 to the surface in the Permian Basin, specifically in the SSAU.

To evaluate the potential seismic risk at SSAU, Oxy 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 seismic events are judged to be from natural causes. Others are near oilfields or water disposal wells and are placed in the category of "quakes in close association with human enterprise."[4] In December 2022, Oxy reviewed the United States Geological Survey (USGS) database of recorded earthquakes at M3.0 or greater in the Permian Basin and found that none have occurred at or near the SSAU. The nearest recorded earthquake occurred in 1992 and was located approximately 30 miles away. Oxy also participates in the TexNet seismic monitoring network[5] and will continue to monitor for seismic signals that could indicate the creation of potential leakage pathways in SSAU.

The absence of any M3.0 or greater seismic events at or near SSAU indicates that Oxy's injection operations at SSAU do not induce seismicity. Also, natural seismicity is not significant in the area. Therefore, Oxy concludes there is no likely seismicity pathway for CO_2 Surface Leakage.

In addition, Oxy is not aware of any reported loss of injectant (brine water or CO_2) to the surface above SSAU associated with any seismic activity. If induced seismicity resulted in a pathway for material amounts of CO_2 to migrate from the injection zone, Oxy's other reservoir fluid monitoring provisions (e.g., reservoir pressure, well pressure, and pattern monitoring) would detect the migration and lead to further investigation.

5.4 Previous Operations

CO_2 flooding was initiated in SSAU in 1983. To obtain permits for CO_2 flooding, the AoR around all CO_2 injector wells was evaluated for the presence of any known and unknown penetrations and to assess if corrective actions were required. As indicated in Section 5.1, this evaluation reviewed the identified penetrations and determined that no additional corrective actions were 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. Throughout its CO_2 EOR operations, Oxy's constructs wells with materials that are designed to be compatible with CO_2 injection. These practices ensure that there are no unknown penetrations within SSAU and that the risk of a release from legacy wells has been evaluated (as already indicated, no

[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

corrective actions were required). Oxy's continuous monitoring program, described above in section 5.1, further mitigates the risk of a CO_2 Surface Leakage from the identified penetrations. The successful experience with CO_2 flooding in SSAU demonstrates that the confining zone has not been impaired by previous operations.

5.5 Pipelines and Surface Equipment

As part of routine risk management described in Section 5.1, the potential risk of Surface Leakage associated with the following were identified and evaluated:

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

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

The risk of pipeline and surface equipment leakage is mitigated through:

- Adhering to regulatory requirements for well drilling and testing;
- Implementing best practices Oxy has developed through its extensive operating experience;
- Monitoring injection and production performance, wellbores, and the surface; and,
- Maintaining subsurface and surface equipment.

Personnel continuously monitor the pipeline using the Supervisory Control and Data Acquisition (SCADA) system and can 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 CO_2 EOR projects in the oil and gas industry. Operating and maintenance practices currently follow and will continue to follow demonstrated industry standards. CO_2 delivery via the Permian Basin CO_2 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 Surface Leakage be detected from pipeline or surface equipment, the mass of CO_2 Surface Leakage will be quantified following the requirements of Subpart W of EPA's Greenhouse Gas Reporting Program (GHGRP).

5.6 Lateral Migration Outside the SSAU

It is highly unlikely that injected CO_2 will migrate downdip and laterally outside the SSAU because of the nature of the geology and the approach Oxy uses for injection. The SSAU boundary contains a local structural high of the San Andres formation, as well as overlying and underlying formations. As injected CO_2 will rise vertically upward over long periods of time, the SSAU structure forms a

trap configuration that funnels the injected CO_2 towards the crest of the structure, thereby preventing lateral migration beyond the unit boundary. In addition, the planned injection mass and active fluid management during injection operations will prevent CO_2 from migrating laterally out of the structure. Finally, the total mass of fluids contained in the SSAU will stay relatively constant. Based on site characterization and planned and projected operations, it is estimated that the total mass of stored CO_2 will be considerably less than the calculated storage capacity.

5.7 Drilling in the SSAU

The TRRC regulates well drilling activity in Texas. Pursuant to TRRC rules, well casing shall be securely anchored in the hole to control the well effectively at all times, all usable-quality water zones shall be isolated and sealed off effectively to 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 re-entered. Well drilling activity at SSAU is conducted in accordance with TRRC rules. Oxy's visual inspection process, including routine site visits, will identify any unapproved drilling activity in the SSAU.

In addition, Oxy intends to operate SSAU 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 CO_2. Consequently, the risks associated with third parties penetrating the SSAU 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 ensures 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 investigations as to the cause.

5.9 Leakage Detection, Verification, and Quantification

Oxy monitors the potential sources of CO_2 Surface Leakage. Table 3 summarizes the range of identified potential scenarios that could result in CO_2 Surface Leakage, the monitoring activities designed to detect such leakage, and Oxy's standard response.

Table 3—Response Plan for CO_2 Emitted from Surface Leakage

Risk	Monitoring Plan	Response Plan
Tubing Leak	Monitor changes in tubing and annulus pressure; Mechanical Integrity Testing (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 bottomhole pressure control	Blowout during well operations	Expeditiously conduct well kill procedures
Unplanned wells drilled through San Andres	Routine field inspection to prevent unapproved drilling; compliance with TRRC permitting for planned wells	Ensure compliance with TRRC regulations
Loss of seal in abandoned wells	Reservoir pressure in WAG Skids; 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 Skids; high pressure found in new wells	Fluid management along lease lines
Leakage through induced fractures	Reservoir pressure in WAG Skids; high pressure found in new wells	Comply with rules for keeping injection pressures below parting pressure
Leakage due to seismic event	Reservoir pressure in WAG Skids; high pressure found in new wells	Shut in injectors near seismic event, assess reservoir and take corrective action as needed

Given the uncertainty concerning the nature and characteristics of any leaks that may be encountered, Oxy will determine the most appropriate method to quantify the volume of CO_2 using an event-driven process 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. The potential quantification methods may include, but are not limited to:

- For leakage through wellbores, continuous SCADA monitoring data provide the basis to determine duration and the amount of CO_2 loss;
- For leakage from surface equipment and pipelines, continuous SCADA monitoring data and acceptable emission factors, such as those in 40 CFR Part §98 Subpart W, provide the basis to determine duration and the amount of CO_2 loss;
- For leakage related to the competency of the confining layer, reservoir modeling and engineering estimates provide the basis for determining the amount of CO_2 loss.

CO_2 Surface Leakage will be documented, evaluated, and addressed in a timely manner. Records of CO_2 Surface Leakage 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.

5.10 Summary

The structure and stratigraphy of the San Andres reservoir in the SSAU is ideally suited for the injection and storage of CO_2. The stratigraphy within the CO_2 injection zones is porous, permeable, and thick, providing ample capacity for long-term CO_2 storage. The reservoir is overlain by several intervals of impermeable geologic zones that form effective seals for fluids in the reservoir. After assessing the potential risk of release from the subsurface and mitigating the risk of leakage from wellbores, it has been determined that the potential threat of CO_2 Surface Leakage is extremely low.

In summary, based on a careful assessment of the potential risk of release of CO_2 from the subsurface, it has been determined that there are no leakage pathways at the SSAU that are likely to result in CO_2 Surface Leakage. Further, given the detailed knowledge of the field and its operating protocols, it is concluded that in the unlikely event CO_2 leakage to the surface occurs, either through identified or unexpected leakage pathways, it would be detected quickly, quantified, and addressed promptly.

6. Monitoring and Considerations for Calculating Site-Specific Variables

Monitoring will be used to determine the quantities in the mass balance equations and to make the demonstration that the CO_2 plume will not migrate to the surface after CO_2 injection is discontinued.

The first part of this section describes how site-specific monitoring will be used to quantify the variables used in the mass balance equations discussed in Section 8 below. The second part of this section describes the monitoring program in place to collect data for the demonstration that the CO_2 plume will not migrate to the surface and support the request to discontinue monitoring described in Sections 4.3 and 9.

6.1 Variables for the Mass Balance Equation

6.1.1 General Monitoring Procedures

Flow rate, pressure, and CO_2 gas composition data are monitored and collected from the SSAU 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 SSAU follow the prevailing industry standard(s) for custody transfer as currently promulgated by the American Petroleum Institute (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 and calibrated 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 CO_2 Received

Oxy measures the volumetric rate of received CO_2 using a commercial custody transfer meter at the point at which custody of the CO_2 from the Permian Basin CO_2 pipeline delivery system is transferred to the SSAU, marked as flow meter M2 on Figure 5. This meter measures flow rate continually. The transfer is a commercial transaction that is documented. In accordance with §98.444(a)(3)(ii), Oxy uses CO_2 concentration data from the commercial sales contract. No CO_2 is received at the SSAU in containers.

6.1.3 CO_2 Injected in the Subsurface

In accordance with §98.444(b)(1), Oxy measures the flow rate of injected CO_2 using the custody transfer meter M2, on Figure 5, and at the outlet of the SGPP, flow meter M3, on Figure 5. In accordance with §98.444(b)(2), the flow rate will be collected quarterly. In accordance with §98.444(b)(3), CO_2 concentration will be sampled at least once per quarter.

6.1.4 CO_2 Produced and Entrained in Products

In accordance with §98.444(c), Oxy measures CO_2 produced at flow meter M4 on Figure 5, that is located at the outlet of the separation unit that sends the CO_2 stream to the injection wells. CO_2 concentration and flow rates will be collected quarterly.

CO_2 that is entrained (i.e., dissolved) in produced oil and natural gas, as indicated in Figure 5, is measured using volumetric flow through the custody transfer meters (M5 and M6).

6.1.5 CO_2 from Equipment Leaks and Vented Emissions of CO_2

In accordance with §98.444(d), Oxy uses 40 CFR §98 Subpart W to estimate the mass of CO_2 emitted from equipment leaks at the SSAU. In accordance with §98.446(f)(3), Oxy will report CO_{2FI} and CO_{2FP}.

6.2 Detection and Quantification of CO_2 Surface Leakage

Oxy uses a multi-layered, risk-based monitoring program for event-driven incidents designed to meet two objectives: 1) to detect problems before CO_2 is emitted by Surface Leakage; and 2) to detect and quantify any CO_2 Surface Leakage that does occur. This section discusses how this monitoring will be conducted and used to quantify the mass of CO_2 Surface Leakage.

6.2.1 Monitoring Potential CO_2 Emissions 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 CO_2 Surface Leakage from the subsurface.

Reservoir simulation modeling, confirmed with 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 CO_2 emissions by Surface Leakage may be occurring. Excursions are

not necessarily indicators of Surface Leakage; 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 CO_2 Surface 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 record in the computerized maintenance management system (CMMS). This record enables the tracking of progress on investigating potential leaks and, if CO_2 has been emitted by Surface Leakage, to quantify its magnitude.

Likewise, a forecast of the rate and composition of produced fluids is developed using the reservoir simulation model. Each producer well is assigned to a specific SAT and is isolated during each cycle for a well production test. The data from the test results are 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 will be initiated. As in the case of injection pattern monitoring, if the investigation leads to a work order in the CMMS, this record will provide the basis for tracking the outcome of the investigation and if a leak has occurred, recording the quantity Surface Leakage. If a CO_2 release in the flood zone were detected, an investigation would be conducted that would include an appropriate method to quantify the mass of any CO_2 confirmed to have been emitted by Surface Leakage. This might include use of material balance equations based on known injected quantities and monitored pressures in the injection zone to estimate the mass of CO_2 involved.

Generally, it is highly unlikely that a subsurface release at SSAU will lead to CO_2 Surface Leakage. In the unlikely event that there are indications of a potential subsurface release, Oxy would determine the appropriate approach for tracking subsurface release to determine whether there was a risk of CO_2 Surface Leakage, address and remedy the release and quantify any actual CO_2 Surface Leakage. To quantify CO_2 Surface Leakage, the relevant parameters (e.g., the rate, concentration, and duration of CO_2 Surface Leakage) would be either be directly measured or estimated to quantify the release mass. Depending on specific circumstances, these determinations may rely on engineering estimates.

In the event a release from the subsurface occurred diffusely through the seals to the surface, the CO_2 Surface Leakage would necessarily include H_2S, which is also present in the SSAU, which would trigger the alarm on the personal monitors worn by field personnel. CO_2 Leakage from the subsurface to the surface have not occurred in the SSAU. If CO_2 Surface Leakage was detected, personnel would use modeling, engineering estimates, and direct measurements to assess, address, and quantify the mass of CO_2 Surface Leakage.

6.2.2. Monitoring of Wellbores

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

CO_2 Surface Leakage from wellbores would be detected through the follow-up investigation of pressure anomalies, visual inspection, or the use of personal H_2S monitors.

Anomalies in injection zone pressure may not indicate CO_2 Surface Leakage. However, if an investigation leads to a work order, field personnel would inspect the equipment in question and determine the nature of the problem. Where possible, repairs will be made with materials on hand and the mass of CO_2 Surface Leakage would be included in the 40 CFR Part §98 Subpart W report for the SSAU. If repairs require additional time and materials, the appropriate approach for quantifying mass of CO_2 Surface Leakage using the relevant parameters (e.g., the rate, concentration, and duration) 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 any identified issues. Where possible, repairs will be made with materials on hand at the time of inspection and the mass of CO_2 Surface Leakage would be included in the 40 CFR Part §98 Subpart W report for SSAU. If repairs require additional time and materials, the affected well would be shut in, a work order would be generated, and the appropriate approach for quantifying the mass of CO_2 Surface Leakage using the relevant parameters (e.g., the rate, concentration, and duration) would be determined. The work order would serve as the basis for tracking the event for GHG reporting.

Because a CO_2 release 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 SSAU is employed to detect unexpected releases from wellbores and surface facilities. 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 CO_2 emissions.

Finally, the data collected by the H_2S monitors, which are always worn by all field personnel, are used as an additional method to detect CO_2 Surface Leakage from wellbores. The H_2S monitors' detection limit is 10 ppm; if an H_2S 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, H_2S is considered a proxy for potential CO_2 Surface Leakage in the field; thus, detected H_2S will be investigated to determine any if confirmed CO_2 Surface Leakage is occurring. If the incident results in a work order, this will serve as the basis for tracking the event for GHG reporting.

6.2.3. Other Potential CO_2 Emissions by Surface Leakage

The same visual inspection process and H_2S monitoring system for identifying potential CO_2 Surface Leakage s from wellbores will be used to detect other potential CO_2 Surface Leakage. Routine visual inspections are used to detect CO_2 Surface Leakage. 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 conducting a general observation of the facility for visible CO_2 emissions. If problems are detected, field personnel would investigate, and, if maintenance is required, generate a work order in the CMMS, which is tracked through completion. In addition to these visual inspections, the results of the personal H_2S monitors worn by field personnel will be used as a supplement to identify CO_2 Surface Leakage that may escape visual detection.

If CO_2 Surface Leakage are detected, they will be reported to surface operations personnel, who will review the reports and conduct a site investigation. If maintenance is required, steps will be taken to prevent further emissions, and a work order will be generated in the CMMS. The work order will describe the appropriate corrective action and be used to track completion of the maintenance action. It will also serve as the basis for tracking the event for GHG reporting and quantifying the mass of CO_2 Surface Leakage.

6.3. Monitoring to Demonstrate that Injected CO_2 Is Not Expected to Migrate to the Surface

At the end of the specified period, Oxy will cease injecting CO_2 for the subsidiary purpose of establishing the long-term storage of CO_2 in the SSAU. Sometime 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 CO_2 reported under 40 CFR §98.440-449 (Subpart RR) is not expected to migrate in the future in a manner likely to result in CO_2 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:

- Data comparing actual performance to predicted performance (purchase, injection, production) over the monitoring period;
- An assessment of the CO_2 Surface Leakage detected, including discussion of the estimated mass of CO_2 emitted and the distribution of emissions by Surface Leakage pathway;
- A demonstration that future operations will not release the injected CO_2 to the surface;
- A demonstration that there has been no significant CO_2 emissions by Surface Leakage; and,
- An evaluation of reservoir pressure that demonstrates that injected fluids are not expected to migrate in a manner to likely to result in Surface Leakage.

7. Determination of Baselines

Existing automatic data systems will be utilized to identify and investigate excursions from expected performance that could indicate CO_2 emissions from the SSAU. Data systems are used primarily for operational control and monitoring and thus 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 CO_2 Surface Leakage will be developed. The following describes the approach to collecting this information.

7.1 Visual Inspections

As field personnel conduct routine inspections, work orders are generated in the CMMS for maintenance activities that cannot be addressed on the spot. Methods to capture work orders that involve activities that could potentially involve CO_2 Surface 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 mass of CO_2 Surface Leakage. Records of information used to calculate emissions will be maintained on file for a minimum of three years.

7.2 Personal H_2S Monitors

Oxy's injection gas compositional analysis indicates H_2S is approximately 1% of the total injected fluid stream. H_2S monitors are worn by all field personnel. The H_2S monitors detect concentrations of H_2S up to 500 ppm in 0.1 ppm increments and will sound an alarm if the detection limit exceeds 10 ppm. If an H_2S 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 H_2S to be a proxy for identifying CO_2 Surface Leakage. The person responsible for MRV documentation will receive notice of all incidents where H_2S 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 of the mass of CO_2 confirmed emitted from any such incidents. Records of information to calculate emissions will be maintained on file for a minimum of three years.

7.3 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 reservoir modeling. The injection targets are programmed into the WAG satellite controllers. High and low set points are also programmed into the controllers, and flags are generated whenever statistically significant deviations from these 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 lead to CO_2 Surface Leakage. The person responsible for the MRV documentation will receive notice of excursions and related work orders that could potentially involve CO_2 Surface Leakage. The Annual Subpart RR Report will provide an estimate of the mass of CO_2 confirmed Surface Leakage. Records of information used to calculate emissions will be maintained on file for a minimum of three years.

7.4 Production Volumes and Compositions

A general forecast of production volumes and composition is developed and used to evaluate performance periodically and refine current and projected injection plans and the forecast. This information is used to make operational decisions, but it is not recorded in an automated data system. Sometimes, this review may result in the generation of a work order in the CMMS. The MRV plan implementation lead will review such work orders and identify those that could result in CO_2 Surface Leakage. Should such events occur, the mass of CO_2 confirmed Surface Leakage 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

This section describes how Oxy uses the equations in Subpart RR §98.443 to calculate the mass of CO_2 received using equations RR-2 and RR-3, the mass of CO_2 injected using equations RR-5

and RR-6, the amount of CO_2 produced using equations RR-8 and RR-9, the mass of CO_2 Surface Leakage using equation RR-10, and the mass of CO_2 sequestered using equation RR-11.

8.1 Mass of CO_2 Received

In accordance with §98.443, Equation RR-2 will be used to calculate the mass of CO_2 Received. In accordance with the requirements at Subpart RR §98.444(a), CO_2 will be measured at the custody transfer meter from the Permian Basin CO_2 pipeline delivery system (M2 on Figure 5). Because there is no redelivery of CO_2, $S_{r,p}$ will be zero ("0"). Quarterly CO_2 concentration will be taken from the gas measurement database. The volumetric flow at standard conditions will be multiplied by the CO_2 concentration and the density of CO_2 at standard conditions to determine net Annual Mass of CO_2 Received.

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

Where:

$CO_{2T,r}$ = Net annual mass of CO_2 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 CO_2 at standard conditions (metric tons per standard cubic meter), 0.0018682;

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

p = Quarter of the year; and

r = Receiving flow meters.

In accordance with §98.443, Equation RR-3 will be used to sum the mass of CO_2 received from all flow meters is calculated in the following equation.

$$CO_2 = \sum_{r=1}^{R} CO_{2T,r} \qquad \text{(Eq. RR-3)}$$

Where:

CO_2 = Total net annual mass of CO_2 received (metric tons).

$CO_{2T,r}$ = Net annual mass of CO_2 received through flow meter r (metric tons).

8.2 Mass of CO_2 Injected into the Subsurface

As described in Section 6.1.3, the amount of CO_2 injected is measured at M2 and M3. In accordance with §98.443, Equation RR-5 will be used to calculate the mass of CO_2 flowing through each of these meters. Quarterly CO_2 concentration will be taken from the gas measurement database. The volumetric flow at standard conditions will be multiplied by the CO_2 concentration and the density of CO_2 at standard conditions to determine net Annual Mass of CO_2 Received.

$$CO_{2,u} = \sum_{p=1}^{4} Q_{p,u} * D * C_{CO2,p,u} \qquad \text{(Eq. RR-5)}$$

Where:

$CO_{2,u}$ = Annual CO_2 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 CO_2 at standard conditions (metric tons per standard cubic meter), 0.0018682;

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

p = Quarter of the year; and

u = Flow meter.

In accordance with §98.443, Equation RR-6 will be used to calculate the total Mass of CO_2 Injected, which is the sum of the Mass of CO_2 from flow meters M2 and M3.

$$CO_{2I} = \sum_{u=1}^{U} CO_{2,u} \qquad \text{(Eq. RR-6)}$$

Where:

$CO_{2,u}$ = Annual CO_2 mass recycled (metric tons) as measured by flow meter u + Net annual mass of CO_2 received through flow meter r (metric tons).

8.3 Mass of CO_2 Produced

In accordance with §98.443, Equation RR-8 will be used the calculate the Mass of CO_2 Produced at flow meter M4 on Figure 5, as described in Section 6.1.4. Quarterly CO_2 concentration will be taken from the gas measurement database. The volumetric flow at standard conditions will be multiplied by the CO_2 concentration and the density of CO_2 at standard conditions to determine net Annual Mass of CO_2 Received.

$$CO_{2w} = \sum_{p=1}^{4} Q_{p,w} * D * C_{CO2,p,w} \quad \text{(Eq. RR-8)}$$

Where:

CO_{2w} = Annual CO_2 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 CO_2 at standard conditions (metric tons per standard cubic meter), 0.0018682;

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

p = Quarter of the year; and

w = Separator.

In accordance with §98.443 Equation RR-9, Oxy will calculate the amount of CO_2 entrained in oil at the custody transfer meters for oil sales, M4.

$$CO_{2,p} = (1+X) * \sum_{w=1}^{W} CO_{2,w} \quad \text{(Eq. RR-9)}$$

Where:

$CO_{2,p}$ = Total annual CO_2 mass produced (metric tons) through all meters in the reporting year;

$CO_{2,w}$ = Annual CO_2 mass produced (metric tons) through meter w in the reporting year;

X = Entrained CO_2 in produced oil or other fluid divided by the CO_2 separated through all separators in the reporting year (weight percent CO_2, expressed as a decimal fraction);

w = Separator

8.4 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 events. Oxy is prepared to address the potential for CO_2 Surface Leakage in a variety of settings. Estimates of the mass of confirmed CO_2 Surface Leakage will depend on several site-specific factors including measurements, engineering estimates, and emission factors, depending on the source and nature of the CO_2 Surface Leakage.

The process for quantifying the mass of CO_2 Surface Leakage will entail using best engineering principles or emission factors. While it is not possible to predict in advance all the types of events that may lead to CO_2 Surface Leakage, some approaches for quantification are described in Sections 5.9 and 6. In the event CO_2 Surface Leakage is confirmed the mass of CO_2 Surface Leakage would be quantified and reported, and records that describe the methods used to estimate or measure the mass emitted 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 the mass of CO_2 Surface Leakage are not double-counted.

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

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

Where:

CO_{2E} = Total annual CO_2 mass emitted by Surface Leakage (metric tons) in the reporting year;

CO_{2x} = Annual CO_2 mass emitted (metric tons) at leakage pathway x in the reporting year; and

x = Leakage pathway.

8.5 Mass of CO_2 Sequestered in Subsurface Geologic Formation

In accordance with §98.443, Equation RR-11 will be used to calculate the Mass of CO_2 Sequestered in Subsurface Geologic Formations in the Reporting Year as follows:

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

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.

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.

8.6 Cumulative Mass of CO_2 Reported as Sequestered in Subsurface Geologic Formation

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

9. MRV Plan Implementation Schedule

This MRV plan will be implemented starting January 1, 2023. GHG reports are filed on March 31 of the year after the reporting year, and Oxy anticipates that the Annual Subpart RR Report will be filed at the same time. Oxy anticipates that the MRV program will be in effect during the specified period, during which time one of the operating purposes will be to establish long-term containment of a measurable quantity of CO_2 in subsurface geological formations at the SSAU.

Oxy anticipates that it will be able to demonstrate that a quantifiable mass of CO_2 injected during the specified period will be stored such that it will not migrate in the future in a manner that likely to result in Surface Leakage. At the end of the specified period, 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:

10.1.1 CO_2 Received and Injected

- The quarterly flow rate of CO_2 received by pipeline is measured at the receiving custody transfer meters.
- The quarterly CO_2 flow rate for recycled CO_2 is measured at the flow meter located at the SGPP outlet.

10.1.2 CO_2 Produced

- The point of measurement for the quantity of CO_2 produced from oil or other fluid production wells is a flow meter at the outlet 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 SGPP flow meter used to measure flow rate of the gas stream, and the CO_2 concentration of the sample will be measured.
- The quarterly flow rate of the produced gas is measured at the flow meters located at the SGPP inlet.

10.1.3 CO_2 Emissions from Equipment Leaks and Vented Emissions of CO_2

The mass of CO_2 emitted from equipment leaks and vented emissions are measured in conformance with the monitoring and QA/QC requirements specified in Subpart W of 40 CFR Part §98.

10.1.4 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 either industry standard practices or an appropriate standard method published by a consensus-based standards organization; and,
- Calibrated, when necessary, using National Institute of Standards and Technology (NIST) methods that are traceable.

10.1.5 Concentration of CO_2

CO_2 concentration is measured using an industry standard practice or an appropriate standard method. Further, all measured CO_2 has been converted to standard cubic meters at a temperature of 60°F 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 CO_2 received that is missing will be estimated using invoices or using a representative flow rate value from the nearest previous time period.
- A quarterly CO_2 concentration of a CO_2 stream received that is missing will be estimated using invoices or using a representative concentration value from the nearest previous time period.
- A quarterly quantity of CO_2 injected that is missing will be estimated using a representative quantity of CO_2 injected from the nearest previous time period at a similar injection pressure.
- For any values associated with CO_2 emissions from equipment leaks and vented emissions of CO_2 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 will be followed.
- The quarterly quantity of CO_2 produced from subsurface geologic formations that is missing will be estimated using a representative quantity of CO_2 produced from the nearest previous time period.

10.3 MRV Plan Revisions

Within 180 days of a material change to the monitoring and/or operational parameters of the CO_2 EOR operations in the SSAU that is not anticipated in this MRV plan, a change in UIC permit class, EPA notification of substantive errors in this MRV plan or monitoring report, or if Oxy chooses to revise this MRV plan, the MRV plan will be revised and submitted to the EPA Administrator 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 CO_2 received at standard conditions and operating conditions, operating temperature and pressure, and concentration of these streams.
- Quarterly records of produced CO_2, including volumetric flow at standard conditions and operating conditions, operating temperature and pressure, and concentration of these streams.
- Quarterly records of injected CO_2 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 CO_2 emitted by Surface Leakage.
- 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 flow meter used to measure injection quantity and the injection wellhead.
- 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 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

Table 4 presents the well name and number, API number, type, and status for active wells in SSAU 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 CO_2 gas.
  - INJ_WAG refers to wells that inject water and CO_2 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.

Table 4—SSAU Well Numbers, Types, and Status

The Well Name & Number, API Number, Well Type, and Well Status are all from OXYODS.MDMODS.Well_All. They include only Oxy Operated wells with a field name like SEMINOLE (SAN ANDRES).

Well Name & Number from OXYODS	**API Number**	**Well Type**	**Well Status as of November 2022**
SSAU-3901	42165000220000	INJ_WAG	ACTIVE
SSAU-1301	42165000230000	PROD_OIL	ACTIVE
SSAU-0701	42165000240000	PROD_OIL	ACTIVE
SSAU-3902	42165000250000	INJ_WAG	ACTIVE
SSAU-1302	42165000260000	INJ_WAG	ACTIVE
SSAU-0702	42165000270000	INJ_WAG	ACTIVE
SSAU-3903	42165000290000	PROD_OIL	P & A
SSAU-1303	42165000300000	PROD_OIL	TA
SSAU-0703	42165000310000	PROD_OIL	ACTIVE
SSAU-3904	42165000320000	PROD_OIL	ACTIVE
SSAU-1304	42165000330000	PROD_OIL	ACTIVE
SSAU-0704	42165000340000	PROD_OIL	P & A
SSAU-3905W	42165000350000	INJ_WAG	ACTIVE
SSAU-0705	42165000360000	PROD_OIL	ACTIVE
SSAU-3906	42165000370000	PROD_OIL	ACTIVE
SSAU-1306	42165000380000	INJ_WAG	ACTIVE
SSAU-0706	42165000390000	INJ_H2O	ACTIVE
SSAU-3907	42165000400000	PROD_OIL	ACTIVE
SSAU-0707	42165000410000	INJ_H2O	ACTIVE
SSAU-3908	42165000420000	INJ_WAG	ACTIVE
SSAU-1102	42165000520000	INJ_WAG	P & A
SSAU-1202	42165000650000	PROD_OIL	ACTIVE
SSAU-3602	42165000660000	PROD_OIL	TA
SSAU-4801	42165000670000	PROD_OIL	ACTIVE
SSAU-1201	42165000690000	INJ_H2O	P & A
SSAU-4302	42165000720000	PROD_OIL	ACTIVE
SSAU-4303W	42165000730000	INJ_WAG	ACTIVE
SSAU-4304	42165000740000	INJ_WAG	ACTIVE
SSAU-4305	42165000750000	INJ_WAG	ACTIVE
SSAU-4306	42165000760000	INJ_WAG	ACTIVE
SSAU-4307	42165000770000	INJ_WAG	ACTIVE
SSAU-4308	42165000780000	INJ_WAG	ACTIVE
SSAU-4309	42165000790000	PROD_OIL	TA
SSAU-0401	42165000820000	INJ_H2O	ACTIVE

SSAU-0501	42165000830000	INJ_H2O	ACTIVE
SSAU-0402	42165000840000	PROD_OIL	P & A
SSAU-0502	42165000850000	PROD_OIL	ACTIVE
SSAU-0801	42165000980000	PROD_OIL	ACTIVE
SSAU-3501W	42165000990000	INJ_H2O	TA
SSAU-3502	42165001000000	PROD_OIL	ACTIVE
SSAU-3503	42165001010000	INJ_WAG	ACTIVE
SSAU-3504	42165001020000	INJ_WAG	SHUT-IN
SSAU-3505	42165001030000	INJ_WAG	ACTIVE
SSAU-3506	42165001040000	PROD_OIL	TA
SSAU-3507W	42165001050000	INJ_WAG	ACTIVE
SSAU-3508	42165001060000	PROD_OIL	ACTIVE
SSAU-3509	42165001070000	INJ_WAG	SHUT-IN
SSAU-3510	42165001080000	INJ_WAG	TA
SSAU-3511	42165001090000	INJ_WAG	ACTIVE
SSAU-3512	42165001100000	PROD_OIL	P & A
SSAU-3513W	42165001110000	INJ_WAG	ACTIVE
SSAU-3514	42165001120000	INJ_WAG	ACTIVE
SSAU-3515	42165001130000	PROD_OIL	P & A
SSAU-3516	42165001140000	PROD_OIL	TA
SSAU-6401	42165001700000	PROD_OIL	ACTIVE
SSAU-6402	42165001710000	INJ_WAG	ACTIVE
SSAU-6403	42165001720000	PROD_OIL	ACTIVE
SSAU-6404	42165001730000	PROD_OIL	ACTIVE
SSAU-6405	42165001740000	PROD_OIL	ACTIVE
SSAU-6406W	42165001750000	INJ_H2O	TA
SSAU-6407	42165001760000	PROD_OIL	ACTIVE
SSAU-2401W	42165001880000	INJ_WAG	ACTIVE
SSAU-2402	42165001890000	PROD_OIL	ACTIVE
SSAU-2403	42165001900000	PROD_OIL	ACTIVE
SSAU-2404	42165001910000	INJ_WAG	ACTIVE
SSAU-6001	42165001920000	PROD_OIL	TA
SSAU-5301	42165001930000	INJ_WAG	ACTIVE
SSAU-5302	42165001940000	PROD_OIL	ACTIVE
SSAU-5303	42165001950000	PROD_OIL	ACTIVE
SSAU-5304W	42165001960000	INJ_WAG	ACTIVE
SSAU-5305	42165001970000	INJ_WAG	ACTIVE
SSAU-5306	42165001980000	PROD_OIL	ACTIVE
SSAU-5307	42165001990000	PROD_OIL	ACTIVE
SSAU-5308W	42165002000000	INJ_WAG	P & A
SSAU-2701	42165002040000	INJ_WAG	ACTIVE

SSAU-2702	42165002050000	PROD_OIL	ACTIVE
SSAU-2703W	42165002060000	INJ_WAG	ACTIVE
SSAU-2704W	42165002070000	INJ_WAG	ACTIVE
SSAU-2705	42165002080000	PROD_OIL	ACTIVE
SSAU-2706	42165002090000	PROD_OIL	ACTIVE
SSAU-2707	42165002160000	INJ_WAG	ACTIVE
SSAU-2708	42165002170000	PROD_OIL	ACTIVE
SSAU-0601	42165002270000	INJ_H2O	ACTIVE
SSAU-4001	42165002290000	PROD_OIL	P & A
SSAU-1401	42165002300000	PROD_OIL	ACTIVE
SSAU-3701	42165002310000	INJ_WAG	ACTIVE
SSAU-4002W	42165002320000	INJ_WAG	ACTIVE
SSAU-1402W	42165002330000	INJ_H2O	P & A
SSAU-3702	42165002340000	PROD_OIL	ACTIVE
SSAU-4003	42165002350000	INJ_H2O	P & A
SSAU-1403	42165002360000	INJ_WAG	ACTIVE
SSAU-4004	42165002370000	PROD_OIL	ACTIVE
SSAU-1404	42165002380000	PROD_OIL	ACTIVE
SSAU-4005	42165002390000	INJ_H2O	P & A
SSAU-1405	42165002400000	PROD_OIL	ACTIVE
SSAU-4006	42165002410000	PROD_OIL	ACTIVE
SSAU-1406	42165002420000	INJ_WAG	ACTIVE
SSAU-4007	42165002430000	PROD_OIL	INACTIVE
SSAU-1407	42165002440000	PROD_OIL	ACTIVE
SSAU-4008	42165002450000	INJ_WAG	ACTIVE
SSAU-1408	42165002460000	INJ_H2O	P & A
SSAU-3601	42165002520000	INJ_H2O	TA
SSAU-1504	42165002570000	PROD_OIL	ACTIVE
SSAU-1505W	42165002580000	INJ_WAG	P & A
SSAU-1506	42165002590000	INJ_WAG	ACTIVE
SSAU-1507	42165002600000	PROD_OIL	ACTIVE
SSAU-5901	42165002630000	PROD_OIL	ACTIVE
SSAU-5902	42165002640000	PROD_OIL	TA
SSAU-3801	42165002690000	INJ_WAG	INACTIVE
SSAU-3802	42165002700000	PROD_OIL	INACTIVE
SSAU-3803	42165002710000	PROD_OIL	P & A
SSAU-3804	42165002720000	PROD_OIL	ACTIVE
SSAU-3805	42165002730000	PROD_OIL	INACTIVE
SSAU-3806	42165002740000	INJ_H2O	ACTIVE
SSAU-1901	42165002800000	PROD_OIL	ACTIVE
SSAU-1902	42165002820000	INJ_WAG	ACTIVE

SSAU-1903	42165002830000	PROD_OIL	ACTIVE
SSAU-1904	42165002840000	PROD_OIL	ACTIVE
SSAU-1905A	42165002850000	PROD_OIL	ACTIVE
SSAU-3301	42165002920000	INJ_WAG	P & A
SSAU-3302	42165002930000	PROD_OIL	ACTIVE
SSAU-3303	42165002940000	INJ_WAG	INACTIVE
SSAU-3304	42165002950000	PROD_OIL	ACTIVE
SSAU-1801	42165003180000	INJ_WAG	ACTIVE
SSAU-1305	42165003400000	PROD_OIL	P & A
SSAU-6408	42165003410000	INJ_H2O	ACTIVE
SSAU-0201	42165003420000	PROD_OIL	TA
SSAU-0202	42165003430000	INJ_H2O	INACTIVE
SSAU-5101	42165003440000	INJ_WAG	ACTIVE
SSAU-5102	42165003450000	INJ_WAG	ACTIVE
SSAU-5103	42165003460000	PROD_OIL	ACTIVE
SSAU-1501	42165003620000	PROD_OIL	ACTIVE
SSAU-1502	42165003630000	INJ_WAG	ACTIVE
SSAU-1503	42165003690000	PROD_OIL	TA
SSAU-6301	42165003870000	PROD_OIL	ACTIVE
SSAU-6302	42165003880000	PROD_OIL	ACTIVE
SSAU-6303	42165003890000	PROD_OIL	ACTIVE
SSAU-6304	42165003900000	INJ_WAG	ACTIVE
SSAU-6305	42165003910000	INJ_H2O	ACTIVE
SSAU-6306	42165003920000	PROD_OIL	ACTIVE
SSAU-6307	42165003930000	INJ_H2O	ACTIVE
SSAU-6308	42165003940000	PROD_OIL	INACTIVE
SSAU-7301	42165004090000	PROD_OIL	ACTIVE
SSAU-7302	42165004100000	PROD_OIL	ACTIVE
SSAU-8201	42165004110000	PROD_OIL	INACTIVE
SSAU-8202	42165004120000	PROD_OIL	P & A
SSAU-8203	42165004130000	PROD_OIL	P & A
SSAU-7701	42165004140000	PROD_OIL	ACTIVE
SSAU-7702	42165004150000	INJ_H2O	ACTIVE
SSAU-8101	42165004160000	PROD_OIL	INACTIVE
SSAU-8102	42165004170000	PROD_OIL	ACTIVE
SSAU-8103	42165004180000	PROD_OIL	INACTIVE
SSAU-8104	42165004190000	INJ_H2O	ACTIVE
SSAU-7401W	42165004230000	INJ_H2O	P & A
SSAU-6101	42165004240000	PROD_OIL	ACTIVE
SSAU-4501	42165008710000	PROD_OIL	P & A
SSAU-8401	42165009570000	INJ_H2O	P & A

SSAU-5601	42165009880000	PROD_OIL	ACTIVE
SSAU-5602	42165009890000	PROD_OIL	P & A
SSAU-5603	42165009900000	PROD_OIL	P & A
SSAU-3001	42165011170000	PROD_OIL	INACTIVE
SSAU-0301	42165011180000	PROD_OIL	P & A
SSAU-3401W	42165011950000	INJ_WAG	ACTIVE
SSAU-3402	42165012040000	PROD_OIL	ACTIVE
SSAU-3403	42165012050000	PROD_OIL	ACTIVE
SSAU-3404	42165012060000	INJ_WAG	ACTIVE
SSAU-2807	42165012130000	PROD_OIL	ACTIVE
SSAU-2808	42165012140000	INJ_WAG	ACTIVE
SSAU-1601	42165012320000	INJ_WAG	ACTIVE
SSAU-1602	42165012330000	PROD_OIL	ACTIVE
SSAU-1603	42165012340000	PROD_OIL	ACTIVE
SSAU-1604	42165012350000	INJ_WAG	ACTIVE
SSAU-1605	42165012360000	PROD_OIL	ACTIVE
SSAU-1606W	42165012370000	INJ_WAG	ACTIVE
SSAU-1607	42165012380000	PROD_OIL	ACTIVE
SSAU-1608	42165012390000	INJ_WAG	ACTIVE
SSAU-2601	42165012430000	PROD_OIL	P & A
SSAU-2501	42165012770000	PROD_OIL	ACTIVE
SSAU-2801	42165012830000	PROD_OIL	P & A
SSAU-2802	42165012840000	INJ_WAG	SHUT-IN
SSAU-2803	42165012850000	PROD_OIL	ACTIVE
SSAU-2804	42165012860000	INJ_WAG	ACTIVE
SSAU-2805W	42165012870000	INJ_WAG	ACTIVE
SSAU-2806	42165012880000	PROD_OIL	ACTIVE
SSAU-0903	42165014280000	INJ_WAG	P & A
SSAU-0902	42165014290000	PROD_OIL	P & A
SSAU-0901W	42165014300000	INJ_WAG	P & A
SSAU-5701	42165014410000	PROD_OIL	P & A
SSAU-0101	42165015120000	INJ_H2O	TA
SSAU-2001	42165015590000	PROD_OIL	P & A
SSAU-0102	42165015620000	PROD_OIL	P & A
SSAU-2202	42165015770000	PROD_OIL	ACTIVE
SSAU-7512	42165015790000	PROD_OIL	P & A
SSAU-5516	42165015800000	INJ_WAG	ACTIVE
SSAU-4101	42165017730000	INJ_WAG	ACTIVE
SSAU-6501	42165017790000	PROD_OIL	P & A
SSAU-6502	42165017800000	INJ_H2O	P & A
SSAU-6503	42165017810000	PROD_OIL	P & A

SSAU-7501	42165017830000	PROD_OIL	ACTIVE
SSAU-7502	42165017840000	PROD_OIL	INACTIVE
SSAU-7503	42165017850000	PROD_OIL	P & A
SSAU-7504	42165017860000	PROD_OIL	ACTIVE
SSAU-7505	42165017870000	PROD_OIL	ACTIVE
SSAU-7506W	42165017880000	INJ_H2O	ACTIVE
SSAU-7507W	42165017890000	INJ_H2O	ACTIVE
SSAU-7508	42165017900000	PROD_OIL	ACTIVE
SSAU-7509	42165017910000	PROD_OIL	INACTIVE
SSAU-7510	42165017920000	PROD_OIL	ACTIVE
SSAU-7511	42165017930000	INJ_H2O	ACTIVE
SSAU-5501	42165017940000	PROD_OIL	ACTIVE
SSAU-5502	42165017950000	INJ_WAG	ACTIVE
SSAU-5503	42165017960000	PROD_OIL	P & A
SSAU-5504W	42165017970000	INJ_WAG	ACTIVE
SSAU-5505	42165017980000	PROD_OIL	P & A
SSAU-5506	42165017990000	INJ_WAG	ACTIVE
SSAU-5507	42165018000000	PROD_OIL	ACTIVE
SSAU-5508	42165018010000	INJ_WAG	ACTIVE
SSAU-5509	42165018020000	INJ_WAG	ACTIVE
SSAU-5510	42165018030000	PROD_OIL	ACTIVE
SSAU-5511W	42165018040000	INJ_WAG	ACTIVE
SSAU-5512	42165018050000	PROD_OIL	P & A
SSAU-5513	42165018060000	PROD_OIL	TA
SSAU-5514	42165018070000	PROD_OIL	P & A
SSAU-5515	42165018080000	PROD_OIL	P & A
SSAU-2901	42165018090000	PROD_OIL	ACTIVE
SSAU-2902	42165018100000	INJ_WAG	ACTIVE
SSAU-2903	42165018110000	PROD_OIL	P & A
SSAU-2904W	42165018120000	INJ_WAG	ACTIVE
SSAU-2905	42165018130000	INJ_WAG	SHUT-IN
SSAU-2906	42165018140000	INJ_WAG	ACTIVE
SSAU-2907	42165018150000	PROD_OIL	ACTIVE
SSAU-2908	42165018160000	INJ_WAG	ACTIVE
SSAU-2909	42165018170000	INJ_WAG	TA
SSAU-2910	42165018180000	PROD_OIL	ACTIVE
SSAU-2911	42165018190000	PROD_OIL	TA
SSAU-2912	42165018200000	PROD_OIL	ACTIVE
SSAU-2913W	42165018210000	INJ_H2O	INACTIVE
SSAU-2914	42165018220000	INJ_H2O	ACTIVE
SSAU-4102	42165018230000	PROD_OIL	ACTIVE

SSAU-4103	42165018240000	PROD_OIL	ACTIVE
SSAU-4104W	42165018250000	INJ_WAG	ACTIVE
SSAU-4105	42165018260000	PROD_OIL	ACTIVE
SSAU-4106	42165018270000	PROD_OIL	TA
SSAU-4107	42165018280000	INJ_WAG	ACTIVE
SSAU-4108W	42165018290000	INJ_WAG	ACTIVE
SSAU-4109	42165018300000	PROD_OIL	ACTIVE
SSAU-4110	42165018310000	INJ_WAG	ACTIVE
SSAU-4111	42165018320000	PROD_OIL	ACTIVE
SSAU-4114	42165018330000	INJ_WAG	ACTIVE
SSAU-4116	42165018340000	INJ_WAG	ACTIVE
SSAU-4115	42165018350000	PROD_OIL	ACTIVE
SSAU-4112	42165018360000	INJ_WAG	ACTIVE
SSAU-4113	42165018370000	PROD_OIL	P & A
SSAU-6201	42165018380000	INJ_WAG	ACTIVE
SSAU-6202	42165018390000	PROD_OIL	ACTIVE
SSAU-6203	42165018400000	INJ_WAG	ACTIVE
SSAU-6204	42165018410000	INJ_H2O	ACTIVE
SSAU-6205	42165018420000	PROD_OIL	ACTIVE
SSAU-6206	42165018430000	PROD_OIL	ACTIVE
SSAU-6208	42165018440000	PROD_OIL	P & A
SSAU-6209	42165018450000	INJ_H2O	ACTIVE
SSAU-6210	42165018460000	PROD_OIL	ACTIVE
SSAU-3101	42165018470000	PROD_OIL	ACTIVE
SSAU-3102	42165018480000	INJ_WAG	ACTIVE
SSAU-3103	42165018490000	PROD_OIL	ACTIVE
SSAU-3107	42165018510000	INJ_WAG	P & A
SSAU-3108	42165018520000	PROD_OIL	ACTIVE
SSAU-3109	42165018530000	PROD_OIL	ACTIVE
SSAU-3110	42165018540000	INJ_H2O	ACTIVE
SSAU-3111	42165018550000	PROD_OIL	ACTIVE
SSAU-3106	42165018560000	INJ_WAG	ACTIVE
SSAU-2204	42165018570000	PROD_OIL	ACTIVE
SSAU-2201	42165018580000	INJ_WAG	ACTIVE
SSAU-2203	42165018590000	INJ_WAG	ACTIVE
SSAU-2205	42165018600000	PROD_OIL	P & A
SSAU-2206	42165018610000	PROD_OIL	ACTIVE
SSAU-2208	42165018620000	INJ_WAG	ACTIVE
SSAU-2207	42165018630000	PROD_OIL	INACTIVE
SSAU-2209	42165018640000	PROD_OIL	ACTIVE
SSAU-2210	42165018650000	INJ_WAG	ACTIVE

SSAU-2211	42165018660000	PROD_OIL	ACTIVE
SSAU-3104	42165018730000	INJ_H2O	P & A
SSAU-6207	42165018740000	PROD_OIL	ACTIVE
SSAU-7601	42165018800000	PROD_OIL	ACTIVE
SSAU-7602	42165018810000	PROD_OIL	ACTIVE
SSAU-7603	42165018820000	INJ_H2O	TA
SSAU-7604	42165018830000	PROD_OIL	P & A
SSAU-7001	42165018870000	PROD_OIL	ACTIVE
SSAU-4901	42165020110000	PROD_OIL	ACTIVE
SSAU-4902	42165020120000	PROD_OIL	P & A
SSAU-4903	42165020130000	PROD_OIL	ACTIVE
SSAU-4904	42165020140000	INJ_WAG	ACTIVE
SSAU-4905	42165020150000	PROD_OIL	ACTIVE
SSAU-3201	42165020170000	PROD_OIL	P & A
SSAU-3202	42165020180000	INJ_WAG	INACTIVE
SSAU-3203	42165020190000	PROD_OIL	ACTIVE
SSAU-3204	42165020200000	INJ_WAG	ACTIVE
SSAU-3205	42165020210000	PROD_OIL	TA
SSAU-3206	42165020220000	INJ_WAG	ACTIVE
SSAU-3207	42165020230000	PROD_OIL	ACTIVE
SSAU-3208	42165020240000	INJ_WAG	ACTIVE
SSAU-2301	42165020250000	PROD_OIL	ACTIVE
SSAU-2302	42165020260000	INJ_WAG	ACTIVE
SSAU-2303	42165020270000	PROD_OIL	INACTIVE
SSAU-2304W	42165020280000	INJ_WAG	P & A
SSAU-2305	42165020290000	PROD_OIL	ACTIVE
SSAU-2306	42165020300000	INJ_WAG	ACTIVE
SSAU-2307	42165020310000	PROD_OIL	ACTIVE
SSAU-2308	42165020320000	INJ_WAG	ACTIVE
SSAU-2101	42165020630000	PROD_OIL	ACTIVE
SSAU-1701	42165020650000	PROD_OIL	ACTIVE
SSAU-1702	42165020660000	PROD_OIL	ACTIVE
SSAU-1101	42165020680000	PROD_OIL	ACTIVE
SSAU-1001	42165020690000	PROD_OIL	ACTIVE
SSAU-1002W	42165020700000	INJ_WAG	ACTIVE
SSAU-1003	42165020710000	INJ_WAG	ACTIVE
SSAU-1004	42165020720000	PROD_OIL	ACTIVE
SSAU-1005	42165020730000	PROD_OIL	ACTIVE
SSAU-1006W	42165020740000	INJ_WAG	ACTIVE
SSAU-1007	42165020750000	PROD_OIL	ACTIVE
SSAU-1008	42165020760000	INJ_WAG	ACTIVE

SSAU-1009	42165020770000	PROD_OIL	ACTIVE
SSAU-1010	42165020790000	INJ_WAG	ACTIVE
SSAU-5201A	42165024290000	PROD_OIL	ACTIVE
SSAU-5202	42165024300000	INJ_WAG	ACTIVE
SSAU-5203	42165024310000	PROD_OIL	P & A
SSAU-5204A	42165024330000	INJ_WAG	ACTIVE
SSAU-5401	42165025670000	PROD_OIL	ACTIVE
SSAU-5402	42165025680000	PROD_OIL	ACTIVE
SSAU-5403	42165025690000	INJ_WAG	P & A
SSAU-5404W	42165025700000	INJ_WAG	ACTIVE
SSAU-4201	42165025740000	INJ_WAG	P & A
SSAU-4202	42165025750000	PROD_OIL	TA
SSAU-4203	42165025760000	INJ_WAG	P & A
SSAU-4204	42165025770000	INJ_WAG	ACTIVE
SSAU-7513	42165025950000	PROD_OIL	P & A
SSAU-3105A	42165025990000	PROD_OIL	P & A
SSAU-2602A	42165028350000	INJ_WAG	ACTIVE
SSAU-2502	42165028520000	INJ_WAG	ACTIVE
SSAU-5801	42165032350000	PROD_OIL	TA
SSAU-5702	42165032360000	PROD_OIL	P & A
SSAU-5704	42165032380000	PROD_OIL	TA
SSAU-5705	42165032390000	INJ_H2O	P & A
SSAU-6901	42165032410000	PROD_OIL	P & A
SSAU-7201	42165033030000	PROD_OIL	ACTIVE
SSAU-5001A	42165033170000	INJ_WAG	ACTIVE
SSAU-2214	42165100130000	PROD_OIL	ACTIVE
SSAU-2603	42165100340000	PROD_OIL	ACTIVE
SSAU-4310	42165100700000	PROD_OIL	P & A
SSAU-1508	42165100770000	PROD_OIL	P & A
SSAU-3703	42165101260000	PROD_OIL	P & A
SSAU-3209	42165101610000	PROD_OIL	ACTIVE
SSAU-1906	42165101920000	PROD_OIL	P & A
SSAU-4311	42165101990000	PROD_OIL	ACTIVE
SSAU-4312	42165102000000	PROD_OIL	TA
SSAU-0503	42165102010000	INJ_H2O	P & A
SSAU-3114W	42165106050000	INJ_H2O	P & A
SSAU-3113	42165106300000	PROD_OIL	P & A
SSAU-6211	42165300130000	INJ_H2O	ACTIVE
SSAU-3807	42165300140000	INJ_H2O	P & A
SSAU-3704	42165300150000	INJ_H2O	ACTIVE
SSAU-0403	42165300160000	INJ_H2O	P & A

SSAU-6212	42165300170000	INJ_H2O	ACTIVE
SSAU-7202	42165300180000	INJ_H2O	INACTIVE
SSAU-4907	42165300540000	INJ_H2O	ACTIVE
SSAU-2213	42165300550000	INJ_H2O	TA
SSAU-0303	42165300560000	INJ_H2O	P & A
SSAU-0603	42165300570000	INJ_H2O	ACTIVE
SSAU-4602	42165301250000	INJ_H2O	TA
SSAU-4401	42165301260000	INJ_H2O	ACTIVE
SSAU-2003	42165301270000	INJ_H2O	INACTIVE
SSAU-1907	42165301280000	INJ_H2O	P & A
SSAU-1802	42165301290000	INJ_H2O	TA
SSAU-4802	42165301300000	INJ_H2O	TA
SSAU-8204	42165301310000	INJ_H2O	TA
SSAU-3105R	42165303490000	PROD_OIL	P & A
SSAU-5514R	42165304820000	INJ_WAG	ACTIVE
SSAU-7514	42165304840000	INJ_H2O	ACTIVE
SSAU-1803	42165304850000	INJ_H2O	ACTIVE
SSAU-2915	42165304890000	PROD_OIL	ACTIVE
SSAU-2405	42165305540000	INJ_WAG	ACTIVE
SSAU-3910	42165305550000	PROD_OIL	P & A
SSAU-2406	42165305660000	PROD_OIL	ACTIVE
SSAU-2505	42165305670000	PROD_OIL	TA
SSAU-2504	42165305680000	INJ_WAG	ACTIVE
SSAU-2310	42165311550000	PROD_OIL	ACTIVE
SSAU-4902R	42165311560000	INJ_WAG	ACTIVE
SSAU-2710	42165311570000	INJ_WAG	ACTIVE
SSAU-2810	42165311580000	PROD_OIL	ACTIVE
SSAU-2809	42165311590000	INJ_WAG	ACTIVE
SSAU-2309	42165311600000	PROD_OIL	ACTIVE
SSAU-2312	42165311610000	PROD_OIL	ACTIVE
SSAU-2311	42165311620000	INJ_WAG	ACTIVE
SSAU-2709	42165311760000	PROD_OIL	ACTIVE
SSAU-3119	42165312170000	PROD_OIL	ACTIVE
SSAU-2218	42165312530000	INJ_WAG	ACTIVE
SSAU-2219	42165312540000	PROD_OIL	ACTIVE
SSAU-2217	42165312550000	INJ_WAG	ACTIVE
SSAU-2216	42165312560000	PROD_OIL	ACTIVE
SSAU-2712	42165312640000	INJ_WAG	ACTIVE
SSAU-2711	42165312650000	PROD_OIL	ACTIVE
SSAU-2811	42165312660000	INJ_WAG	ACTIVE
SSAU-2812	42165312670000	PROD_OIL	ACTIVE

SSAU-3116	42165313540000	INJ_WAG	ACTIVE
SSAU-3306	42165313640000	INJ_WAG	ACTIVE
SSAU-3210	42165313650000	PROD_OIL	ACTIVE
SSAU-3305	42165313660000	PROD_OIL	ACTIVE
SSAU-3211	42165313670000	INJ_WAG	ACTIVE
SSAU-3213	42165313720000	INJ_WAG	ACTIVE
SSAU-3212	42165313730000	PROD_OIL	ACTIVE
SSAU-3519	42165313780000	INJ_WAG	ACTIVE
SSAU-3406	42165313790000	INJ_WAG	ACTIVE
SSAU-3517	42165313800000	INJ_WAG	ACTIVE
SSAU-3405	42165313810000	PROD_OIL	ACTIVE
SSAU-3520	42165313820000	PROD_OIL	P & A
SSAU-3118	42165313830000	INJ_WAG	ACTIVE
SSAU-2220	42165313840000	INJ_WAG	ACTIVE
SSAU-3518	42165313850000	PROD_OIL	ACTIVE
SSAU-3117	42165313860000	PROD_OIL	ACTIVE
SSAU-3115	42165314520000	PROD_OIL	ACTIVE
SSAU-3521	42165314660000	INJ_WAG	ACTIVE
SSAU-4313	42165318840000	PROD_OIL	ACTIVE
SSAU-4314	42165318850000	PROD_OIL	P & A
SSAU-4119	42165318860000	INJ_WAG	ACTIVE
SSAU-4315	42165318870000	PROD_OIL	ACTIVE
SSAU-4117	42165318880000	INJ_WAG	ACTIVE
SSAU-4118	42165318890000	PROD_OIL	P & A
SSAU-4011	42165318920000	INJ_WAG	ACTIVE
SSAU-4009	42165318930000	PROD_OIL	ACTIVE
SSAU-0708	42165319020000	PROD_OIL	ACTIVE
SSAU-0709	42165319030000	PROD_OIL	ACTIVE
SSAU-0904	42165319040000	PROD_OIL	ACTIVE
SSAU-1103	42165319050000	PROD_OIL	ACTIVE
SSAU-1308	42165319060000	PROD_OIL	ACTIVE
SSAU-1512	42165319070000	PROD_OIL	TA
SSAU-1511	42165319080000	PROD_OIL	ACTIVE
SSAU-1307	42165319090000	PROD_OIL	ACTIVE
SSAU-1510	42165319100000	PROD_OIL	ACTIVE
SSAU-1509	42165319200000	PROD_OIL	ACTIVE
SSAU-4010	42165319210000	PROD_OIL	ACTIVE
SSAU-4012	42165319220000	PROD_OIL	ACTIVE
SSAU-4015	42165319250000	INJ_WAG	ACTIVE
SSAU-4120	42165319260000	PROD_OIL	ACTIVE
SSAU-4121	42165319270000	INJ_WAG	ACTIVE

SSAU-4122	42165319280000	PROD_OIL	ACTIVE
SSAU-4316	42165319290000	PROD_OIL	ACTIVE
SSAU-4317	42165319300000	PROD_OIL	ACTIVE
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SSAU-4319	42165319320000	PROD_OIL	INACTIVE
SSAU-4320	42165319330000	PROD_OIL	ACTIVE
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SSAU-1203	42165319430000	PROD_OIL	ACTIVE
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SSAU-6412	42165332290000	PROD_OIL	ACTIVE
SSAU-6409	42165332300000	PROD_OIL	TA

SSAU-6411	42165332310000	PROD_OIL	TA
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SSAU-6213	42165332360000	PROD_OIL	TA
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SSAU-4314R	42165369390000	PROD_OIL	ACTIVE
SSAU-3123R	42165369440000	PROD_OIL	ACTIVE
SSAU-5503R	42165369580000	PROD_OIL	ACTIVE
SSAU-3515R	42165369810000	PROD_OIL	ACTIVE
SSAU-4125R	42165369820000	INJ_WAG	ACTIVE
SSAU-3910R	42165374780000	INJ_WAG	ACTIVE
SSAU-3528R	42165374790000	INJ_WAG	ACTIVE
SSAU-3534	42165374800000	PROD_OIL	ACTIVE
SSAU-4322R	42165375550000	PROD_OIL	ACTIVE
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SSAU-3104R	42165377800000	INJ_WAG	ACTIVE
SSAU-3520R	42165377850000	PROD_OIL	ACTIVE
SSAU-4118R	42165378080000	PROD_OIL	ACTIVE
SSAU-6222	42165379860000	INJ_H2O	ACTIVE
SSAU-6219	42165379970000	PROD_OIL	ACTIVE
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SSAU-3107R	42165386730000	INJ_WAG	ACTIVE
SSAU-3703R	42165386740000	PROD_OIL	ACTIVE
SSAU-4021S	42165386760000	PROD_OIL	ACTIVE

12.2 Regulatory References

Regulations cited in this plan:

1. 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

2. Oil and Gas Procedure Manual:
https://www.rrc.texas.gov/oil-and-gas/publications-and-notices/manuals/oil-and-gas-procedure-manual/

Request for Additional Information: Seminole San Andres Unit
May 17, 2023

Instructions: Please enter responses into this table and make corresponding revisions to the MRV Plan as necessary. Any long responses, references, or supplemental information may be attached to the end of the table as an appendix. This table may be uploaded to the Electronic Greenhouse Gas Reporting Tool (e-GGRT) in addition to any MRV Plan resubmissions.

No.	MRV Plan		EPA Questions	Responses
	Section	Page		
1.	N/A	N/A	There is a lack of consistency with hyphens, bolding, quotation marks, spelling, and capitalization throughout the MRV plan. Examples include but are not limited to: H2O vs. H_2O We recommend reviewing the formatting in the MRV plan for consistency. Furthermore, we recommend doing an additional review for spelling, grammar, etc.	- Where "H2O" is part of a proper name, it is fully capitalized. There are no other instances of "H_2O" where it is not used as a proper name. -The rest of the document has been reviewed for spelling and grammar. Editorial corrections have been made as warranted.

No.	MRV Plan		EPA Questions	Responses
	Section	Page		
2.	4	16-17	Per 40 CFR 98.449, active monitoring area is defined as the area that will be monitored over a specific time interval from the first year of the period (n) to the last year in the period (t). The boundary of the active monitoring area is established by superimposing two areas: (1) The area projected to contain the free phase CO_2 plume at the end of year t, plus an all around buffer zone of one-half mile or greater if known leakage pathways extend laterally more than one- half mile. (2) The area projected to contain the free phase CO_2 plume at the end of year t + 5. Per 40 CFR 98.449, maximum monitoring area is defined as equal to or greater than the area expected to contain the free phase CO_2 plume until the CO_2 plume has stabilized plus an all-around buffer zone of at least one-half mile. While the MRV plan identifies the AMA and MMA, please provide further explanation of whether the AMA and MMA meet the definitions in 40 CFR 98.449. For example, please specify whether CO_2 will remain in the unit boundaries at year t, year t+5, and when the CO_2 plume has stabilized as required in the above definitions. What will happen to the CO_2 plume when the facility is no longer producing fluids?	The AMA and MMA are consistent with the definitions in 40 CFR part 98.449. The text in Sections 4.1 and 4.2 have been edited to show this consistency. The expected status of the CO_2 plume after the facility is no longer producing fluids was already described in Section 4.3 and that explanation is also included in Section 4.2.

No.	MRV Plan		EPA Questions	Responses
	Section	Page		
3.	5	N/A	In addition to listing the possible leakage pathways and their monitoring strategies, please provide a clear characterization of the likelihood, magnitude, and timing of leakage for each potential leakage pathway. For example, the format of such a characterization might look like: “leakage from XYZ pathway is unlikely but possible. If it did occur, it would be most likely when pressures are highest during XYZ timeframe, and the leakage could result in XYZ kgs/metric tons before being addressed…”	Eight potential leakage pathways were evaluated: 1. Existing Wellbores, 2. Faults and Fractures, 3. Natural and Induced Seismic Activity, 4. Previous Operations, 5. Pipeline/Surface Equipment, 6. Lateral Migration Outside the SSAU, 7. Drilling Through the CO_2 Area, and 8. Diffuse Leakage Through the Seal. The evaluation concluded that while mitigated, the risk of leakage through wellbores and pipeline/surface equipment was possible. Leakage potential through these pathways is insubstantial and estimated to be well below 1% on the volume of CO_2 flowing through the well or equipment during the event. As described in Section 5, leakage through the other pathways is deemed so unlikely that it is not possible to provide a generic estimate of the potential amount leaked. It would have to be determined on a case by case basis.
4.	5.2	20	“After reviewing geologic and seismic data, Oxy concluded that there are no known faults or significant fractures that transect the San Andres Formation in the project area. As a result, there is no risk of CO2 Surface Leakage due to known fractures or faults.” Please define “significant fracture” or clarify what is intended by the use of the term in this section.	The word “significant” has been removed as there are no known fractures that transect the San Andres Formation in the project area.
5.	5.9	23	“Surface monitoring well allow for detection and quantification of all potential leakage pathways.” While the MRV plan mentions that the facility intends to quantify potential surface leakage, please provide example quantification strategies that may be applied for the pathways identified in the plan.	Section 5.9 has been modified to describe quantification strategies for different categories of leakage pathways.

No.	MRV Plan		EPA Questions	Responses
	Section	Page		
6.	6.1.5	26	In accordance with §98.444(d), Oxy uses 40 CFR §98 Subpart W to estimate the mass of CO_2 emitted from equipment leaks at the SSAU. Subpart W uses a factor-driven approach to estimate CO_2 emitted from equipment leaks. In addition, Oxy uses an event-driven process to assess, address, track, and (if applicable) quantify the mass of CO_2 Surface Leakage. The Subpart W report and results from any event-driven quantification will be reconciled to ensure that emissions at the surface are not double-counted. Oxy applies subpart W to the entire SSAU and does not distinguish between CO_{2FI} and CO_{2FP}, as a result, CO_{2FI} will contain all subpart W emissions for SSAU and CO_{2FP} will be reported as "0." Subpart RR requires equipment leaks and vented emissions for injection and production to be reported separately (see https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-98/subpart-RR#p-98.446(f)(3)). Please update the MRV plan as necessary to reflect this.	The text was modified in accordance with 40 CFR Part 98.446(f)(3) and will report CO_{2FI} and CO_{2FP}.
7.	8.5	34	"CO_{2P} = Total annual CO_2 mass produced (metric tons) net of CO_2 entrained (i.e. dissolved) in oil in the reporting year." In equation RR-11, this variable is "CO_{2P} = Total annual CO_2 mass produced (metric tons) in the reporting year." Equations and variables cannot be modified from the regulations. Please revise this section and ensure that all equations are consistent with those prescribed at 40 CFR 98.443.	This was corrected in Section 8.5.
8.	10.1.2	35	"The quarterly flow rate of the produced gas is measured at the flow meters located at the SGPP inlet." Flow meters used to measure CO_2 produced must be located at the outlet of the separation facilities, not the inlet. Please clarify. For reference, see https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-98/subpart-RR#p-98.444(c).	The text was modified in accordance with 40 CFR Part 98.444(c) and CO_2 will be measured at the outlets of the separator units.

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

December 2022

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1. Introduction

OXY USA INC, a subsidiary of Occidental (Oxy) operates a CO_2-Enhanced Oil Recovery (CO_2-EOR) project in the Seminole San Andres Unit (SSAU). This Monitoring, Reporting, and Verification (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 CO_2 sequestered at the SSAU during a specified period of injection.

2. Facility Information

2.1 Reporter Number

XXXX –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 in-service wells in the SSAU (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 SSAU are currently classified as UIC Class II wells.

2.3 Existing Wells

Wells in the SSAU are identified by name and number, API number, type, and status. The list of wells as of November 2022 is included in Section 12.1. Any changes in these wells or additional wells will be indicated in the annual monitoring report.

3. Project Description

This project takes place in the SSAU, an oilfield located in West Texas that was first produced in 1941. CO_2 flooding was initiated in 1983 and the injection plan calls for an additional total of approximately 174 million metric tons of CO_2 to be stored over the remaining lifetime of the project. The field is well characterized and Oxy determined that it 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 1.0 or very close to it. Oxy constructed a history-matched reservoir simulation of the injection at SSAU.

3.1 Project Characteristics

The Seminole San Andres field was discovered in 1936 and started producing in 1941. The field was unitized in 1968, and waterflood was initiated in 1969. CO_2 flooding was initiated in 1983. A long-term forecast for SSAU was developed using the reservoir modeling approaches described in Section 3.4, including storage of an additional total of approximately 174 million metric tons of CO_2 over the remaining life of the project. Figure 1 shown below, is a graph of the quantity of CO_2 injected, produced and stored between 1983 and 2021 (solid lines) and a forecast of the CO_2 that will be injected, produced and stored between 2022 and 2055 (dashed lines) in the SSAU. Oxy has injected 224 million metric tons (MMT) of CO_2 into the SSAU through the end of 2021. Of that amount, 109 MMT CO_2 was produced and reinjected, and 115 MMT CO_2 was stored. Oxy forecasts CO_2 injection of 532 MMT from the year 2022 until the year 2055, which is currently projected to be the end of the project. Of that amount, 358 MMT is forecast to be produced and 174 MMT will be stored.

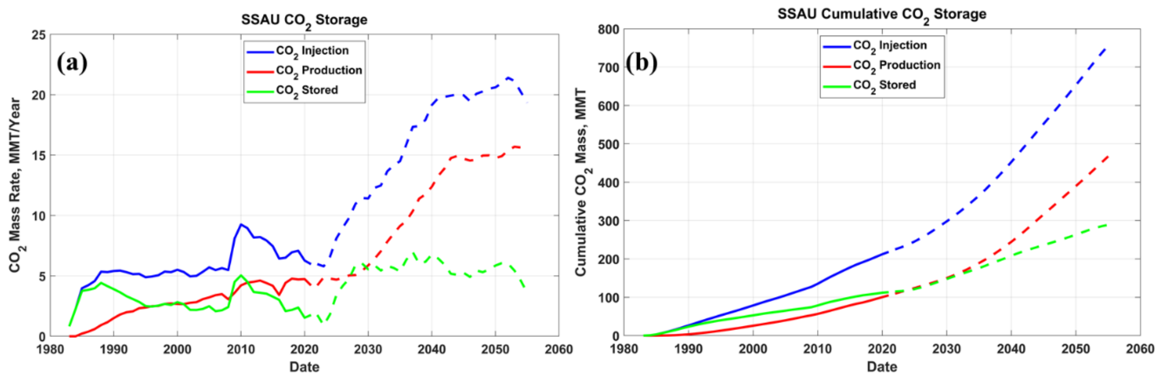

Figure 1—SSAU Historic and Forecast CO_2 Injection, Production, and Storage (a) Rate (MMT/Year), (b) Cumulative Mass (MMT)

3.2 Environmental Setting

The SSAU is located in the northeast portion of the Central Basin Platform in West Texas (Figure 2).

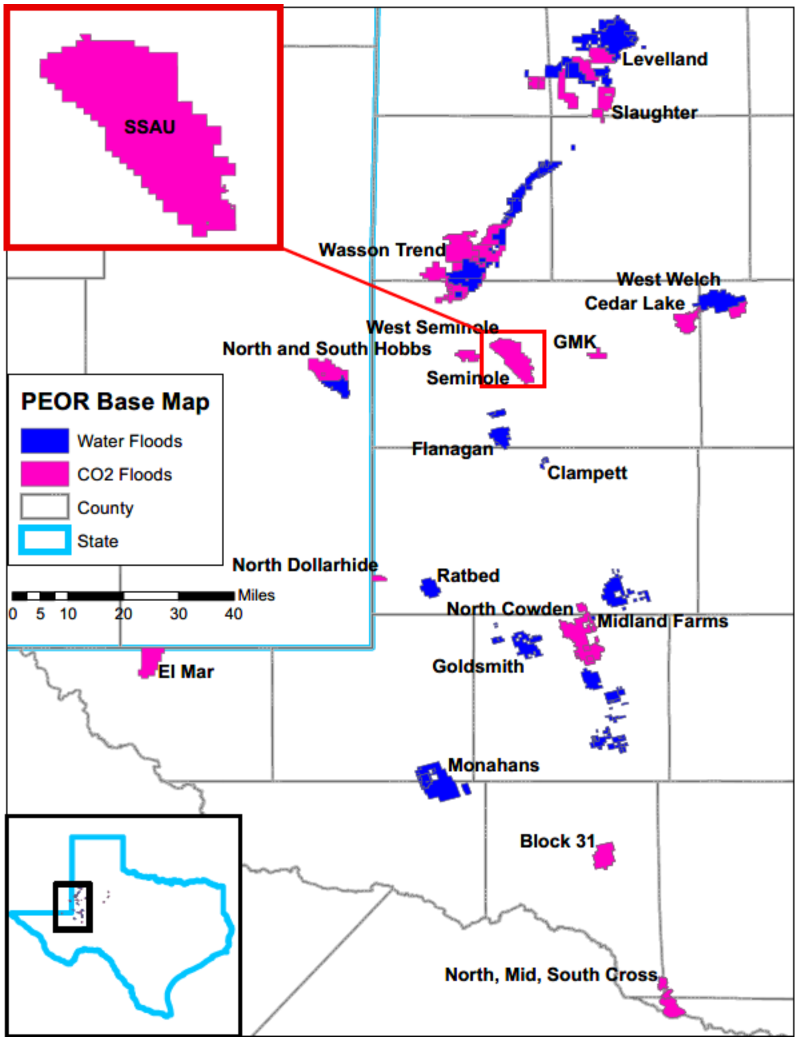

Figure 2—Location of SSAU in West Texas

Figure 3 is a schematic of the SSAU storage complex. The SSAU sequestration zone ranges between 1,165 and 1,850 ft in thickness with an average thickness of 1,600 ft. This productive interval, or reservoir, is within the San Andres Formation and 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.

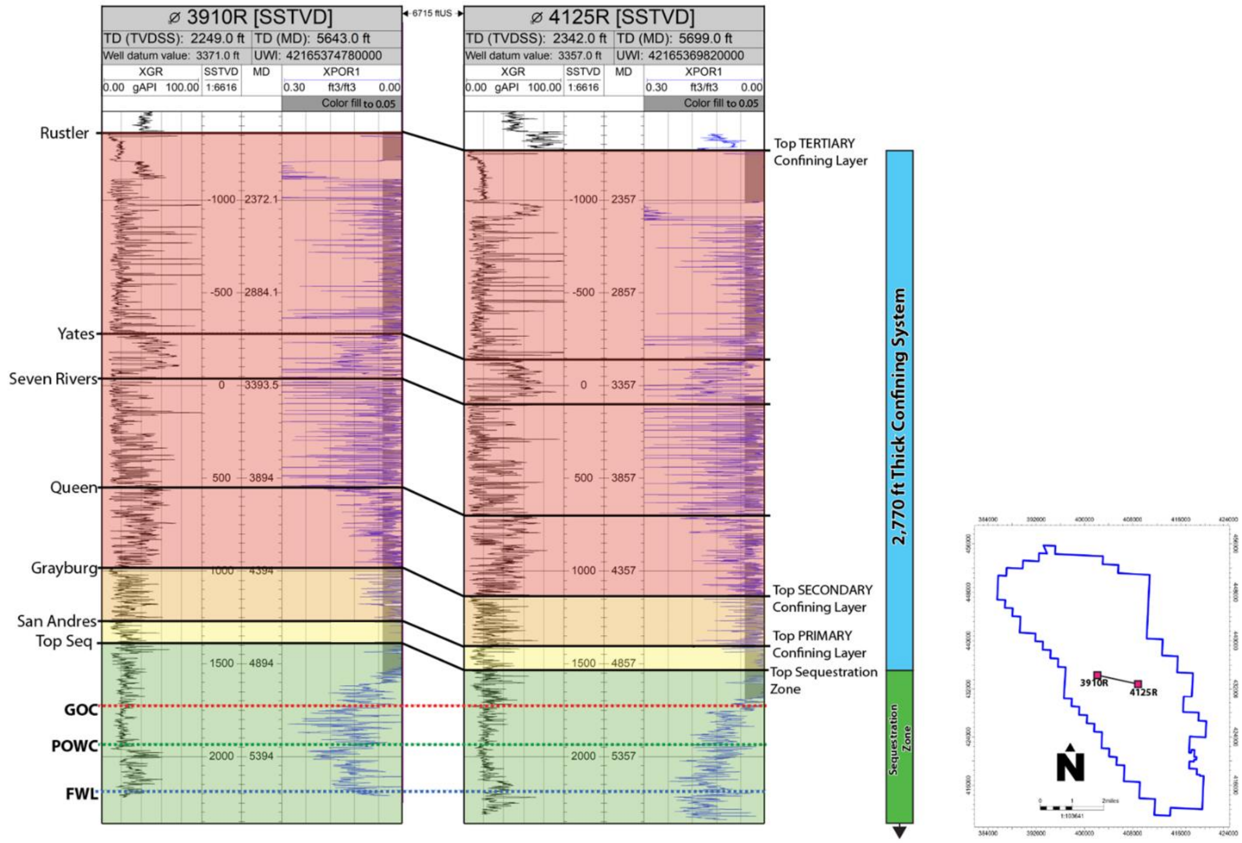

Figure 3—SSAU Geologic Column. Notes: TD = Total Depth, TVDSS or SSTVD = Total Vertical Depth Subsea, MD = Measured Depth, UWI = Unique Well Identification number, XGR = Gamma Ray log, XPOR1 = Porosity log, GOC = Gas Oil Contact, POWC = Producing Oil Water Contact, FWL = Free Water Level.

Figure 3 shows the overlying confining system, which consists of non-porous anhydritic strata that are ~2,770 ft thick and are comprised of three sub-zones:

- A ~95 ft thick primary confining layer between the top of sequestration zone and top of San Andres Formation;
- A ~200 ft thick secondary confining layer between San Andres Formation and Grayburg Formation; and,
- A ~2,350 ft thick tertiary confining layer from the Grayburg Formation to the Rustler Formation.

There are numerous relatively thin layers that provide additional secondary containment between the sequestration zone and freshwater aquifers found at a depth of 250 feet. These layers are comprised of siltstones, shales, salts, and anhydrite sequences with little to no porosity or permeability.

SSAU is located in the Permian Basin on the northeast portion of the Central Basin Platform in West Texas. SSAU is draped over a fault-bounded doubly plunging anticline that tips out in

Devonian strata where several N-NW trending seismically resolvable faults have been identified and mapped. Faults are situated southwest of the structural crest, with a maximum offset of 1,800 ft within Devonian strata and tip out approximately 1,700 ft below the SSAU sequestration zone. Oxy extensively analyzed seismic data acquired over the SSAU to assess potential leakage pathways and basement-rooted faults. Oxy determined that seismic attributes, such as coherence, do not reveal linear discontinuities beyond those currently mapped. Likewise, Oxy found that downhole measurements from profile logs and micro-resistivity imaging tools show no indication of conductive faults or fractures. Pressure-based interference tests and simulation-based history matching also indicate that reservoir behavior has not been modified by faults and fractures. In summary, Oxy determined that multiple fault/fracture characterization tools indicate the sequestration zone and confining system are free of faults and fractures that could act as leakage pathways.

SSAU is a dome structure that includes the highest elevations within the area. The elevated area forms a natural trap for oil and gas that migrated upward from deeper source rocks over millions of years. Once trapped in these higher elevations, the oil and gas remained in place. In the case of SSAU, this oil and gas has been trapped in the reservoir for 50 to 100 million years. Over time, buoyant fluids, including CO_2, rose vertically until reaching the highest elevation of the structure. Figure 4 shows the Top San Andres pay interval structure. The colors in the structure map in Figure 4 indicate the subsurface elevation, with red illustrating a higher or shallower level and dark blue illustrating a lower or deeper level.

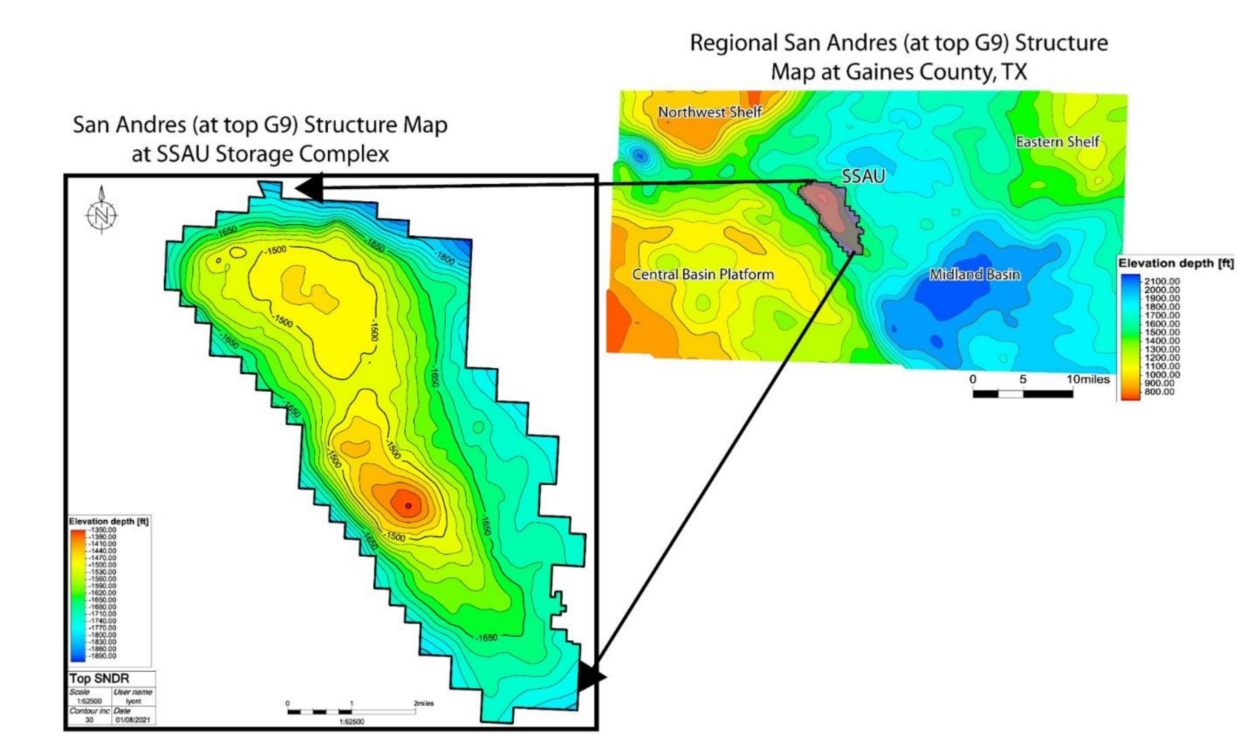

Figure 4—Local Area Structure on Top of San Andres. Note: Top SNDR = Top San Andres

Because of buoyancy differences between oil, water and gas phases, the gas column at SSAU sits above the oil. Water, being the least buoyant of the three fluid phases, is found below the oil. At the time of its discovery, natural gas was trapped at the structural high points of SSAU, 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 Formation. Gas is buoyant and highly mobile. If it could escape SSAU naturally, through faults or fractures, it would have done so over the millennia. Below the gas cap is an oil accumulation called the oil zone. There are no distillable hydrocarbons below the oil zone.

Once the CO_2 flood is complete and injection ceases, the remaining mobile CO_2 will rise slowly upward, driven by buoyancy forces and will be trapped by the confining system. There is more than enough pore space to sequester the planned CO_2 injection. The amount of CO_2 injected will not exceed the reservoir's secure storage capacity; consequently, there is negligible risk that CO_2 could migrate to other reservoirs in the Central Basin Platform. The total reservoir pore volume is calculated to be 5,816 million reservoir barrels (MMRB) from the top of the reservoir down to the base of the oil zone. This equals the volume of rock multiplied by porosity. Table 1 shows the conversion of this amount of pore space into an estimated maximum mass of CO_2 storage of approximately 509 MMT. The total stored CO_2 from previous EOR and the planned forecast injection will fill approximately 57% of the total calculated storage capacity.

Table 1—Calculation of Maximum CO_2 Storage Capacity (MMT) at SSAU

Top of Pay to Free Water Level (2,175 ft subsea)	
Variables	SSAU Outline
Pore Volume (MMRB)	5,816
B_{CO_2}	0.41
S_{wirr}	0.18
S_{orCO_2} (volume weighted)	0.14
Max CO_2 Billion Cubic Feet (Bcf)	9,646
Max CO_2 (MMT)	509

$$\text{Max } CO_2 = \text{Pore Volume (RB)} * (1 - S_{wirr} - S_{orCO_2}) / B_{CO_2}$$

Where:

Max CO_2 = maximum CO_2 storage capacity, MMT
Pore Volume (RB) = volume of the rock formation in Reservoir Barrels
B_{CO_2} = formation volume factor for CO_2
S_{wirr} = irreducible water saturation
S_{orCO_2} = irreducible oil saturation

Oxy has a high degree of confidence that stored CO_2 will be contained securely within the reservoir because: 1) SSAU is located at the highest subsurface elevations in the area; 2) the confining zone has proved competent over millions of years and with current CO_2 flooding; and, 3) SSAU has ample storage capacity.

3.3 Description of CO_2-EOR Project Facilities and the Injection Process

Figure 5 shows a simplified process flow diagram (PFD) of the project facilities and equipment in the SSAU. CO_2 is delivered to SSAU via the Permian Basin CO_2 pipeline network from a number of different sources.

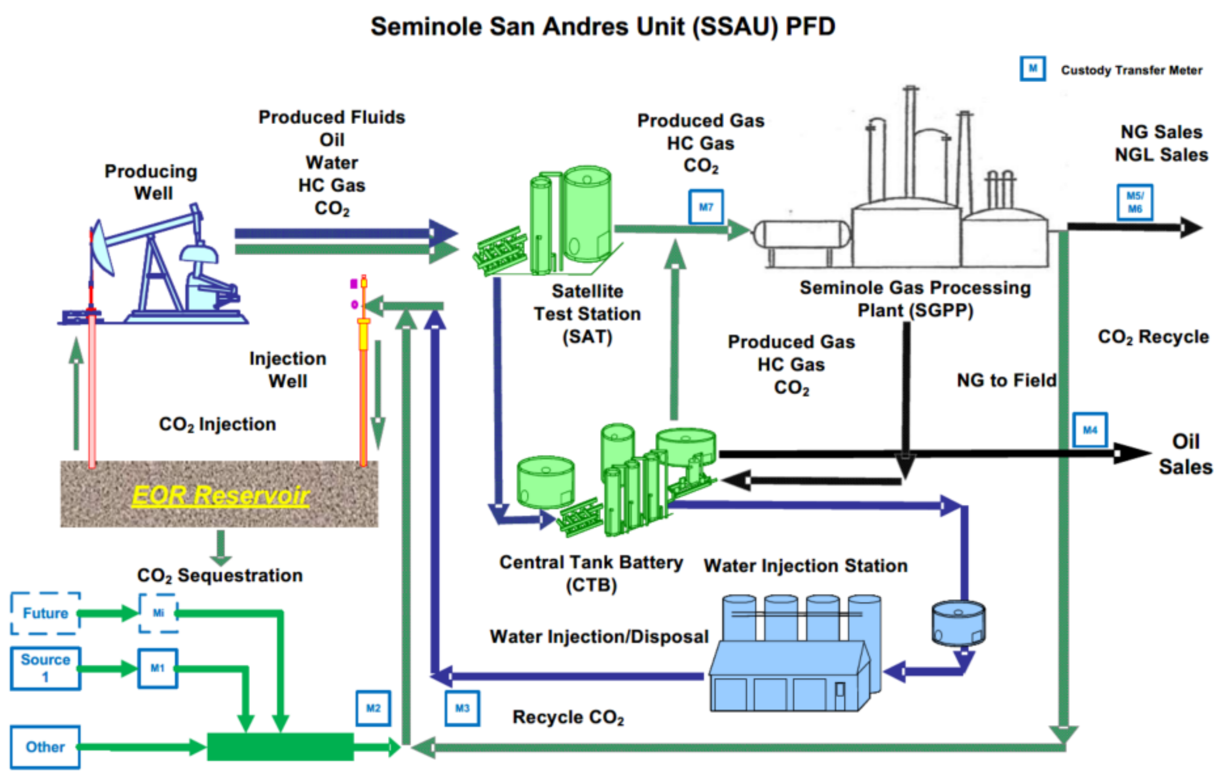

Figure 5—SSAU Process Flow Diagram. Notes: HC = Hydrocarbon, NG = Natural Gas, NGL = Natural Gas Liquids

Once CO_2 enters SSAU, there are three main processes involved in EOR operations:

1. **CO_2 Distribution and Injection.** The mass of CO_2 received at SSAU is metered and calculated through the custody transfer meter located at the pipeline delivery point, as indicated by the box labeled "M2" in the bottom left of Figure 5. The mass of CO_2 received is combined with recycled CO_2 from the Seminole Gas Processing Plant (SGPP), denoted by box labeled "M3," and distributed to the CO_2 trunklines for injection into the injection wells according to the pre-programmed injection plan for each well pattern, which alternates between water and CO_2 injection. This is an EOR project, and reservoir pressure must be maintained above the minimum miscibility pressure (MMP). Therefore, injection pressure is maintained at a level that is sufficiently high to allow injectants to enter the reservoir, but below the formation parting pressure (FPP).

2. **Produced Fluids Handling.** Produced fluids from the production wells are a mixture of oil, hydrocarbon gas, water, CO_2 and trace amounts of other constituents in the field including nitrogen and hydrogen. Fluids are gathered from producer wells and sent to

satellite test stations (SAT) for separation into a gas/CO_2 mix and a produced fluids mix of water, oil, gas, and CO_2. The gas/CO_2 mix, which is composed primarily of hydrocarbons and CO_2, is sent to the SGPP for CO_2 separation, dehydration, sweetening, and compression before reinjection into the reservoir. The mix of water, oil, gas, and CO_2 is sent to the central tank battery (CTB) where water is separated for reinjection or disposal; oil is separated for sale and metered through a custody transfer meter, and then moved into the pipeline; and, the remaining gas/CO_2 mix is combined with gas/CO_2 separated from the produced fluids in the SAT. The total amount of CO_2 produced is measured using meters labeled "M7" and "M3" on Figure 5.

3. **Water Treatment and Injection.** Water is recovered from the CTB for reuse and forwarded to the water injection station for treatment and reinjection using a closed loop process or for disposal.

3.3.1 Wells in the SSAU

The 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 Oil and Gas Procedure Manual (see Appendix 12.2). 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 underground sources of drinking water 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 where they are encountered into other strata, or into subsurface and surface waters;
- A completion report for each well that includes an electric log (e.g., a density, sonic, or resistivity) 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 and the location and setting of plugs; and,
- Injection well operators must identify an Area of Review (AoR), use materials and equipment compatible with the injection fluids, test, and maintain well records.

Table 2 provides a well count by type and status as of November 2022. All these wells are in material compliance with TRRC rules.

Table 2—SSAU Well Penetrations by Type and Status (as November 2022)

Row Labels	ACTIVE	INACTIVE	P&A	SHUT-IN	TA	Grand Total
INJ_H2O	27	4	16	0	10	57
INJ_WAG	190	3	11	4	2	210
PROD_OIL	306	21	60	0	30	417
Grand Total	**523**	**28**	**87**	**4**	**42**	**684**

Notes: INJ_H2O = water injector, INJ_WAG = Water Alternating Gas Injector, PROD_OIL = Oil producer, P&A = Plugged and Abandoned, TA = Temporarily Abandoned

As indicated in Figure 6, wells are distributed across the SSAU. The well patterns currently undergoing CO_2 flooding are outlined in the black box. During the life of the project the well count and status is projected to change as the SSAU injection plan is implemented. Oxy may seek TRRC approval to drill new wells, recomplete existing wells, or plug and abandon existing wells. Such changes will be included in the annual monitoring report.

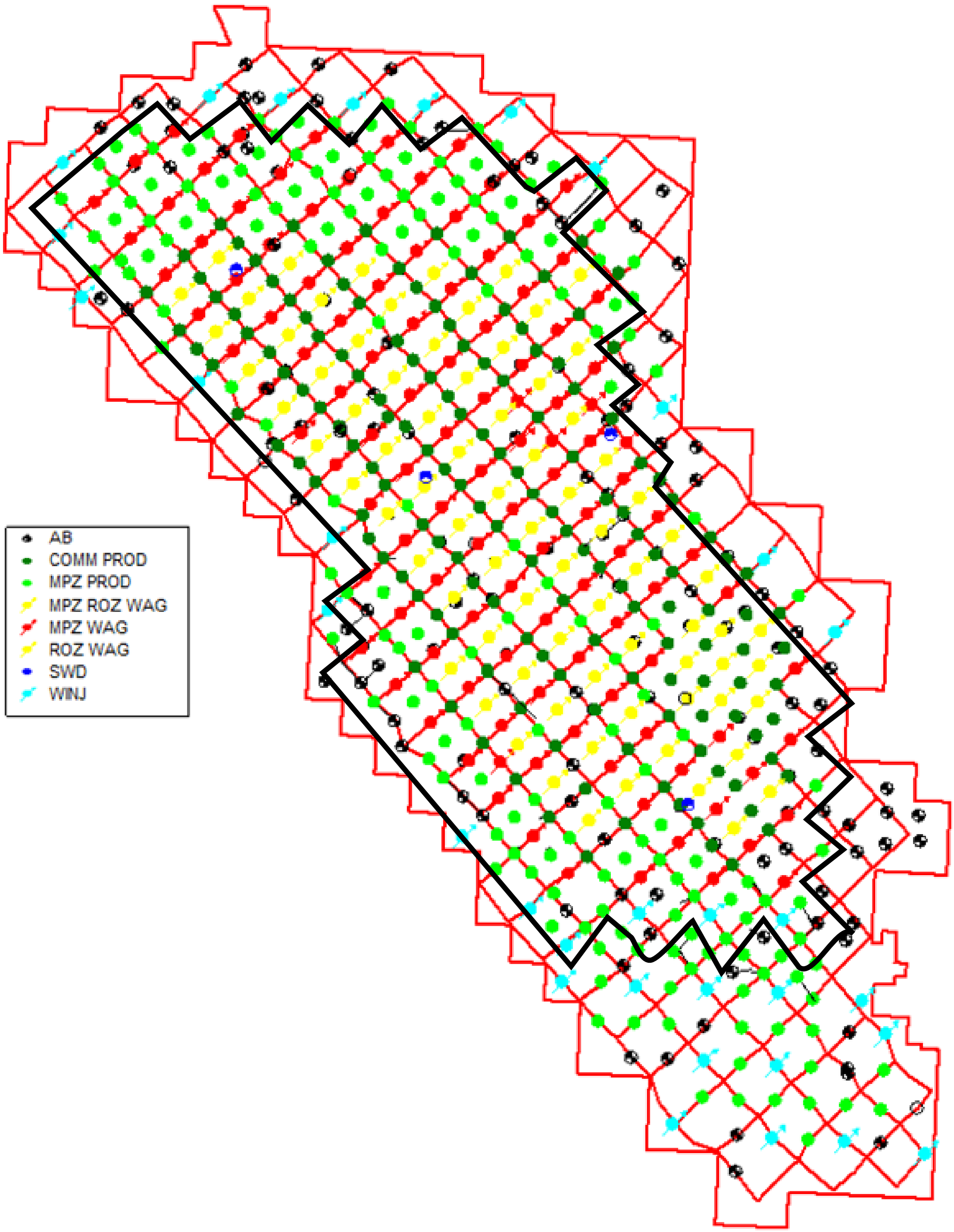

Figure 6—SSAU Wells and Injection Patterns. Notes: AB = Abandoned, COMM PROD = Commingled Producer, MPZ PROD = Main Pay Zone Producer, MPZ ROZ WAG = Main Pay Zone Residual Oil Zone Water Alternating Gas, MPZ WAG = Main Pay Zone Water Alternating Gas, ROZ WAG = Residual Oil Zone Water Alternating Gas, SWD = Salt Water Disposal, WINJ = Water Injector

SSAU CO_2 EOR operations are designed to avoid conditions that could damage the reservoir and create a potential leakage pathway. Oxy manages reservoir pressure by maintaining an injection-to-withdrawal ratio (IWR)[1] of approximately 1.0. To do this, 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 oilfield.

Oxy maintains injection pressure below the FPP, which is measured using step-rate tests.

3.4 Reservoir Modeling

A history-matched reservoir model of the current and forecast SSAU CO_2 injection plan has been constructed using tNavigator, which is a commercially available reservoir simulation software program. The model simulates the recovery mechanism in which CO_2 is miscible with the hydrocarbon phase in the reservoir.

The model was created to:

- Demonstrate that the storage complex has, at the minimum, the capacity to contain the planned mass of injected CO_2; and
- Track injected CO_2, identify how and where CO_2 is trapped in the SSAU, and monitor sequestration mass and distribution.

The reservoir model utilizes four types of data:

1. Site Characteristics as described in the SSAU geomodel,
2. Initial reservoir conditions and fluid property data,
3. Capillary pressure data, and
4. Well data.

The static geomodel that serves as the foundation for the dynamic simulation model used data from digital open- and cased-hole logs of 684 wells within the SSAU boundary to correlate formation tops. Oxy developed a sequence stratigraphic framework for SSAU based on core descriptions and outcrop analogs. Oxy selected the sequence stratigraphic correlations of flow units at the base of mud-dominated flooding surfaces in core, linked to well logs, and extrapolated throughout the field.

The dynamic simulation model is a four-component model consisting of water, oil, reservoir gas, and injected CO_2. It is an extension of the black oil model that enables the modeling of various recovery mechanisms, including miscible injection of CO_2, that is justified because the reservoir under study is above MMP. Oxy used the total hydrocarbon and solvent (CO_2) saturation to calculate relative permeability to water. Oxy then used the solvent and oil relative permeability to

[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.

calculate multipliers from a look-up table. Oxy used the Todd-Longstaff[2] model to calculate the effective viscosity and density of the hydrocarbon and solvent phases.

Oxy conducted history matching on the dynamic simulation model to adjust input parameters within the range of data uncertainties until the actual reservoir performance was closely reproduced in the model. Using this process, Oxy obtained an 84-year history match. 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 four graphs in Figure 7 present the history match results of oil rate, water rate, liquid rate, and gas rate, showing that the reservoir model provides an excellent match to actual historical data. Figure 8 shows the matches of water and CO_2 injection.

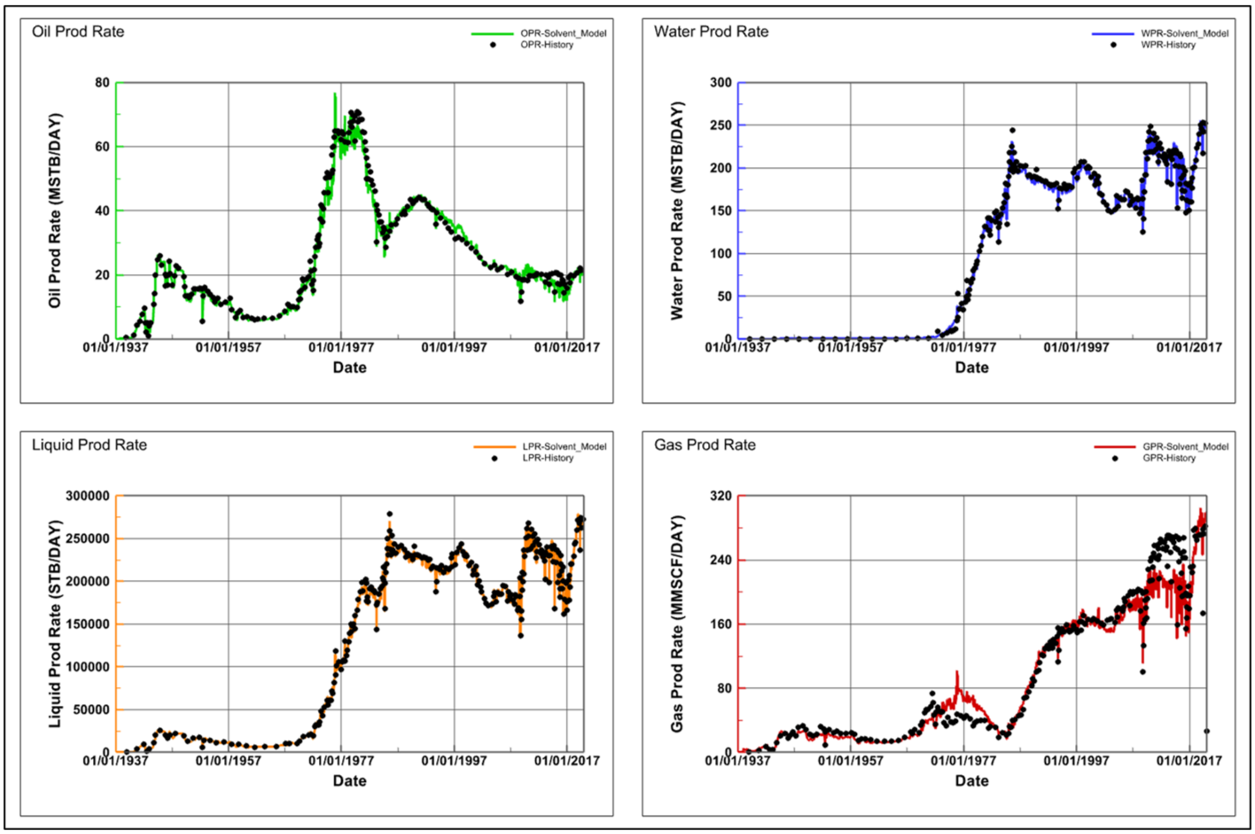

Figure 7—Four Parameters of History-Matched Modeling in the SSAU Reservoir Model. Notes: OPR = Oil Production Rate; WPR = Water Production Rate; MSTB/Day = Thousand Stock Tank Barrels per Day, MMSCF/Day = Million Standard Cubic Feet per Day

[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).

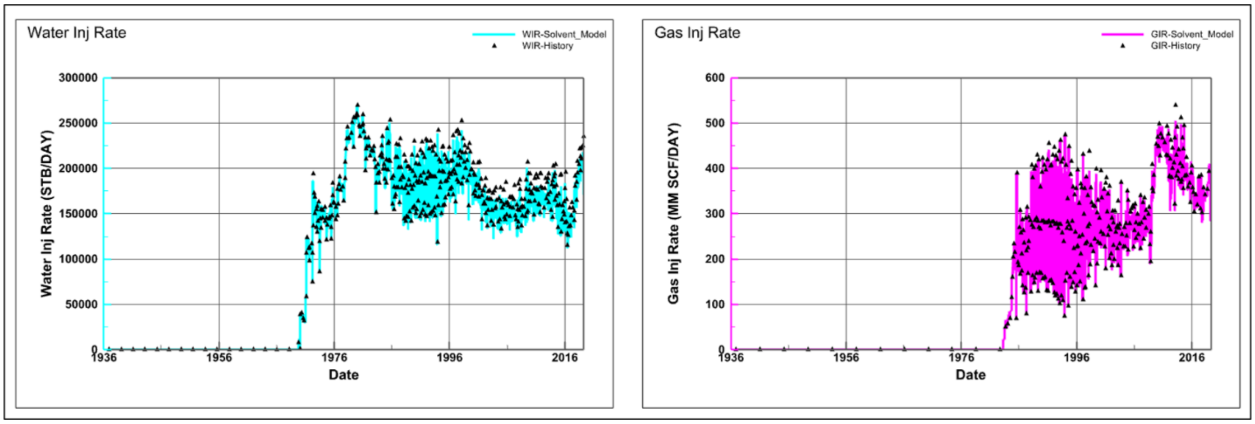

Figure 8—Plots of Injection History Match in the SSAU Reservoir Model. Note: WIR = Water Injection Rate; GIR = Gas Injection Rate

Oxy used the SSAU reservoir model to evaluate the plume of CO_2 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's CO_2 storage performance. The model forecast showed that CO_2 is contained in the reservoir within the boundaries of SSAU.

4. Delineation of Monitoring Area and Timeframes

4.1 Active Monitoring Area

Oxy defines the Active Monitoring Area (AMA) by the boundary of the SSAU plus the required ½-mile buffer, based on the following criteria:

- Oxy operates injector and producer wells throughout the SSAU as indicated in Figure 6.
- CO_2 injected into the SSAU remains contained within the SSAU because of Oxy's fluid and pressure management practices, i.e., the maintained IWR of 1.0 is consistent with stable reservoir pressure. Managed leaseline injection and production wells are used to retain fluids, and operational results confirm that the injected CO_2 is retained within the SSAU.
- The SSAU is a structural high within the formation, therefore CO_2 will migrate updip within the SSAU to the structurally highest position and be retained by the geologic confining unit. CO_2 will not migrate downdip.

Figure 9 shows the unit boundaries in black and the ½ mile buffer in green.

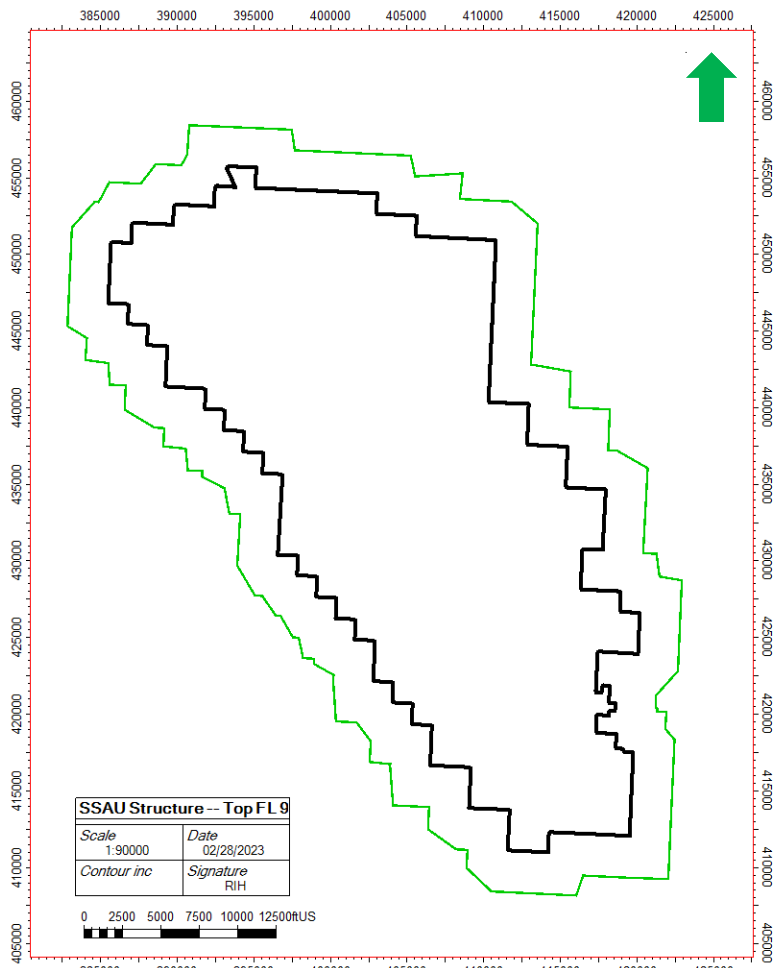

Figure 9—SSAU Unit Boundary with the ½ mile buffer boundary (green)

4.2 Maximum Monitoring Area

The Maximum Monitoring Area (MMA) is defined by the boundary of the SSAU plus the required ½-mile buffer. The maximum extent of CO_2 will be contained within the SSAU, therefore the boundary of SSAU plus ½ mile buffer will allow for monitoring of the injected CO_2. Figure 9 shows the unit boundaries in black with the ½ mile buffer in green.

4.3 Monitoring Timeframes

The primary purpose for injecting CO_2 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 CO_2 in the SSAU. The specified period will be shorter than the period of production from the SSAU.

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

At the conclusion of the specified period, a request for discontinuation of reporting will be submitted with a demonstration that current monitoring and model(s) show that the cumulative mass of CO_2 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 SSAU is collected for use in reservoir modeling and operations management. Reservoir pressure is not forecast to change appreciably because the IWR will be maintained at approximately 1.0. The reservoir model shows that by the end of CO_2 injection, average reservoir pressure will be approximately 2,790 psi. Once injection ceases, reservoir pressure is predicted to stabilize within one year. Over time, reservoir pressure is expected to decline 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.

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

In the 84 years since the SSAU oilfield 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 CO_2 to the surface, including:

1. Existing Wellbores,
2. Faults and Fractures,
3. Natural and Induced Seismic Activity,
4. Previous Operations,
5. Pipeline/Surface Equipment,
6. Lateral Migration Outside the SSAU,
7. Drilling Through the CO_2 Area, and
8. 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 CO_2 flooding, an extensive review of all SSAU penetrations was completed to determine the need for any corrective action. That analysis showed that all penetrations have either been adequately plugged and abandoned or, if still in use, do not require corrective action. All wells Oxy constructed and operates in the SSAU are in compliance with TRRC rules.

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

- CO_2 flood beam-pumped wells,
- Electrical submersible pump (ESP) producer wells,
- Naturally flowing producer wells,
- Hydraulic jet pump producer wells,
- CO_2 WAG injector wells, and
- Water injectors.

A risk assessment undertaken for SSAU classified all risks associated with the 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 SSAU geology is well suited to CO_2 sequestration with an extensive confining zone that is free of fractures and faults that could be potential conduits for CO_2 migration. The low risk is supported by the results of the reservoir model, which shows that stored CO_2 is not predicted to leave the SSAU boundary. Any risks are further mitigated because the SSAU is operated in a manner that maintains, monitors, and documents the integrity of the reservoir.

The risk of well leakage is mitigated through:

- Adhering to regulatory requirements for well drilling and testing;
- Implementing best practices Oxy has developed through its extensive operating experience;
- Monitoring injection and production performance, wellbores, and the surface; and,
- Maintaining surface and subsurface equipment.

Continual and routine monitoring of the wellbores and site operations will be used to detect leaks or other potential well problems, as follows and as discussed in Section 6.1.5 below:

- Pressure in injection wells is monitored on a continual basis. The injection plans for each pattern are programmed into the injection WAG skids to govern the rate, pressure, and duration of either water or CO_2 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 an 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 CO_2 EOR projects, is that such leakage is very rare, and there have been no incidents of fluid migration out of the intended zone at SSAU.
- Production well performance is monitored using the production well tests, when produced fluids are gathered and sent to a 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 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 CO_2 flooding efficiency is optimized. Production well performance that does not meet planned performance is investigated and any identified issues are addressed. Leakage to the outside of production wells is not considered a major risk because reduced pressure in the casing will prevent leakage outside the wellbore. Further, the personal H_2S monitors are designed to detect the presence of leaked fluids around production wells during well inspections.

- Field inspections are conducted on a routine basis by field personnel. CO_2 leaking through an orifice is cold and leads to formation of bright white clouds and ice that are easily spotted. All field personnel are trained to identify leaking CO_2 and other potential problems at wellbores and in the field. Any CO_2 Surface Leakage detected will be documented and reported and quantified.

Based on ongoing monitoring activities and review of the potential leakage risks posed by wellbores, Oxy concludes that the risk of CO_2 Surface Leakage through wellbores is being mitigated by continuous monitoring and by promptly responding to any detected problems as they arise. Any mass of CO_2 Surface Leakage that occurs will be quantified.

5.2 Faults and Fractures

After reviewing geologic and seismic data, Oxy concluded that there are no known faults or significant fractures that transect the San Andres Formation in the project area. As a result, there is no risk of CO_2 Surface Leakage due to known fractures or faults.

Oxy manages injections patterns to ensure that the injection pressure does not exceed formation parting pressure (FPP) and does not induce faults of fractures. Oxy routinely measures and updates FPP and reservoir pressure. Oxy also maintains an IWR at or near 1.0. These practices mitigate the potential for CO_2 injection to induce faults or fractures. As a safeguard, WAG skids are continuously monitored and equipped with automatic shutoff controls should injection pressures exceed programmed settings.

5.3 Natural or Induced Seismicity

After reviewing the literature and actual operating experience, Oxy concluded that there is no direct evidence that natural seismic activity poses a significant risk for loss of CO_2 to the surface in the Permian Basin, specifically in the SSAU.

To evaluate the potential seismic risk at SSAU, Oxy 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 seismic events are judged to be from natural causes. Others are near oilfields or water disposal wells and are placed in the category of “quakes in close association with human enterprise.”[4] In December 2022, Oxy reviewed the United States Geological Survey (USGS) database of recorded earthquakes at M3.0 or greater in the Permian Basin and found that

[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.

none have occurred at or near the SSAU. The nearest recorded earthquake occurred in 1992 and was located approximately 30 miles away. Oxy also participates in the TexNet seismic monitoring network[5] and will continue to monitor for seismic signals that could indicate the creation of potential leakage pathways in SSAU.

The absence of any M3.0 or greater seismic events at or near SSAU indicates that Oxy's injection operations at SSAU do not induce seismicity. Also, natural seismicity is not significant in the area. Therefore, Oxy concludes there is no likely seismicity pathway for CO_2 Surface Leakage.

In addition, Oxy is not aware of any reported loss of injectant (brine water or CO_2) to the surface above SSAU associated with any seismic activity. If induced seismicity resulted in a pathway for material amounts of CO_2 to migrate from the injection zone, Oxy's other reservoir fluid monitoring provisions (e.g., reservoir pressure, well pressure, and pattern monitoring) would detect the migration and lead to further investigation.

5.4 Previous Operations

CO_2 flooding was initiated in SSAU in 1983. To obtain permits for CO_2 flooding, the AoR around all CO_2 injector wells was evaluated for the presence of any known and unknown penetrations and to assess if corrective actions were required. As indicated in Section 5.1, this evaluation reviewed the identified penetrations and determined that no additional corrective actions were 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. Throughout its CO_2 EOR operations, Oxy's constructs wells with materials that are designed to be compatible with CO_2 injection. These practices ensure that there are no unknown penetrations within SSAU and that the risk of a release from legacy wells has been evaluated (as already indicated, no corrective actions were required). Oxy's continuous monitoring program, described above in section 5.1, further mitigates the risk of a CO_2 Surface Leakage from the identified penetrations. The successful experience with CO_2 flooding in SSAU demonstrates that the confining zone has not been impaired by previous operations.

5.5 Pipelines and Surface Equipment

As part of routine risk management described in Section 5.1, the potential risk of Surface Leakage associated with the following were identified and evaluated:

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

As described in Section 5.1, the risk assessment classified all subsurface risks as low, 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 SSAU is operated in a manner that maintains, monitors, and documents the integrity of the reservoir.

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

The risk of pipeline and surface equipment leakage is mitigated through:

- Adhering to regulatory requirements for well drilling and testing;
- Implementing best practices Oxy has developed through its extensive operating experience;
- Monitoring injection and production performance, wellbores, and the surface; and,
- Maintaining subsurface and surface equipment.

Personnel continuously monitor the pipeline using the Supervisory Control and Data Acquisition (SCADA) system and can 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 CO_2 EOR projects in the oil and gas industry. Operating and maintenance practices currently follow and will continue to follow demonstrated industry standards. CO_2 delivery via the Permian Basin CO_2 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 Surface Leakage be detected from pipeline or surface equipment, the mass of CO_2 Surface Leakage will be quantified following the requirements of Subpart W of EPA's Greenhouse Gas Reporting Program (GHGRP).

5.6 Lateral Migration Outside the SSAU

It is highly unlikely that injected CO_2 will migrate downdip and laterally outside the SSAU because of the nature of the geology and the approach Oxy uses for injection. The SSAU boundary contains a local structural high of the San Andres formation, as well as overlying and underlying formations. As injected CO_2 will rise vertically upward over long periods of time, the SSAU structure forms a trap configuration that funnels the injected CO_2 towards the crest of the structure, thereby preventing lateral migration beyond the unit boundary. In addition, the planned injection mass and active fluid management during injection operations will prevent CO_2 from migrating laterally out of the structure. Finally, the total mass of fluids contained in the SSAU will stay relatively constant. Based on site characterization and planned and projected operations, it is estimated that the total mass of stored CO_2 will be considerably less than the calculated storage capacity.

5.7 Drilling in the SSAU

The TRRC regulates well drilling activity in Texas. Pursuant to TRRC rules, well casing shall be securely anchored in the hole to control the well effectively at all times, all usable-quality water zones shall be isolated and sealed off effectively to 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 re-entered. Well drilling activity at SSAU is conducted in accordance with TRRC rules. Oxy's visual inspection process, including routine site visits, will identify any unapproved drilling activity in the SSAU.

In addition, Oxy intends to operate SSAU 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 CO_2. Consequently, the risks associated with third parties penetrating the SSAU 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 ensures 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 investigations as to the cause.

5.9 Leakage Detection, Verification, and Quantification

Oxy monitors the potential sources of CO_2 Surface Leakage. Oxy uses an event-driven process to assess, address, track, and (if applicable) quantify any potential CO_2 Surface Leakage. Table 3 summarizes the range of identified potential scenarios that could result in CO_2 Surface Leakage, the monitoring activities designed to detect such leakage, the standard response, and other applicable regulatory programs requiring similar reporting. Surface monitoring will allow for detection and quantification of all potential leakage pathways.

Given the uncertainty concerning the nature and characteristics of any CO_2 Surface Leakage, the most appropriate methods for quantifying the mass of CO_2 Surface Leakage will be determined on a case-by-case basis. 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.

Any mass of CO_2 Surface Leakage confirmed will be quantified using acceptable emission factors, such as those found in 40 CFR Part §98 Subpart W. Oxy will use engineering estimates of CO_2 Surface Leakage based on measurements in the subsurface, field experience, and other factors, such as the frequency of inspection. CO_2 Surface Leakage will be documented, evaluated, and addressed in a timely manner. Records of CO_2 Surface Leakage 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 3—Response Plan for CO_2 Emitted from Surface Leakage

Risk	Monitoring Plan	Response Plan
Tubing Leak	Monitor changes in tubing and annulus pressure; Mechanical Integrity Testing (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 bottomhole pressure control	Blowout during well operations	Expeditiously conduct well kill procedures
Unplanned wells drilled through San Andres	Routine field inspection to prevent unapproved drilling; compliance with TRRC permitting for planned wells	Ensure compliance with TRRC regulations
Loss of seal in abandoned wells	Reservoir pressure in WAG Skids; 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 Skids; high pressure found in new wells	Fluid management along lease lines
Leakage through induced fractures	Reservoir pressure in WAG Skids; high pressure found in new wells	Comply with rules for keeping injection pressures below parting pressure
Leakage due to seismic event	Reservoir pressure in WAG Skids; high pressure found in new wells	Shut in injectors near seismic event, assess reservoir and take corrective action as needed

5.10 Summary

The structure and stratigraphy of the San Andres reservoir in the SSAU is ideally suited for the injection and storage of CO_2. The stratigraphy within the CO_2 injection zones is porous, permeable, and thick, providing ample capacity for long-term CO_2 storage. The reservoir is overlain by several intervals of impermeable geologic zones that form effective seals for fluids in the reservoir. After assessing the potential risk of release from the subsurface and mitigating the risk of leakage from wellbores, it has been determined that the potential threat of CO_2 Surface Leakage is extremely low.

In summary, based on a careful assessment of the potential risk of release of CO_2 from the subsurface, it has been determined that there are no leakage pathways at the SSAU that are likely to result in CO_2 Surface Leakage. Further, given the detailed knowledge of the field and its operating protocols, it is concluded that in the unlikely event CO_2 leakage to the surface occurs, either through identified or unexpected leakage pathways, it would be detected quickly, quantified, and addressed promptly.

6. Monitoring and Considerations for Calculating Site-Specific Variables

Monitoring will be used to determine the quantities in the mass balance equations and to make the demonstration that the CO_2 plume will not migrate to the surface after CO_2 injection is discontinued.

The first part of this section describes how site-specific monitoring will be used to quantify the variables used in the mass balance equations discussed in Section 8 below. The second part of this section describes the monitoring program in place to collect data for the demonstration that the CO_2 plume will not migrate to the surface and support the request to discontinue monitoring described in Sections 4.3 and 9.

6.1 Variables for the Mass Balance Equation

6.1.1 General Monitoring Procedures

Flow rate, pressure, and CO_2 gas composition data are monitored and collected from the SSAU 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 SSAU follow the prevailing industry standard(s) for custody transfer as currently promulgated by the American Petroleum Institute (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 and calibrated 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 CO_2 Received

Figure 5Oxy measures the volumetric rate of received CO_2 using a commercial custody transfer meter at the point at which custody of the CO_2 from the Permian Basin CO_2 pipeline delivery system is transferred to the SSAU, marked as flow meter M2 on Figure 5. This meter measures flow rate continually. The transfer is a commercial transaction that is documented. In accordance with §98.444(a)(3)(ii), Oxy uses CO_2 concentration data from the commercial sales contract. No CO_2 is received at the SSAU in containers.

6.1.3 CO_2 Injected in the Subsurface

In accordance with §98.444(b)(1), Oxy measures the flow rate of injected CO_2 using the custody transfer meter M2, on Figure 5, and at the outlet of the SGPP, flow meter M3, on Figure 5. In accordance with §98.444(b)(2), the flow rate will be collected quarterly. In accordance with §98.444(b)(3), CO_2 concentration will be sampled at least once per quarter.

6.1.4 CO_2 Produced and Entrained in Products

In accordance with §98.444(c), Oxy measures CO_2 produced at flow meter M7 on Figure 5, that is located directly downstream of the separation unit that sends the CO_2 stream to the recycling facility. CO_2 concentration and flow rates will be collected quarterly.

CO_2 that is entrained (i.e., dissolved) in produced oil and natural gas, as indicated in Figure 5, is measured using volumetric flow through the custody transfer meters (M4, M5 and M6). M7 already includes the amount of CO_2 entrained in natural gas (M5 and M6) but does not include the amount of CO_2 entrained in oil (M4). Therefore, total CO_2 produced is measured by adding M4 and M7.

6.1.5 CO_2 from Equipment Leaks and Vented Emissions of CO_2

In accordance with §98.444(d), Oxy uses 40 CFR §98 Subpart W to estimate the mass of CO_2 emitted from equipment leaks at the SSAU. Subpart W uses a factor-driven approach to estimate CO_2 emitted from equipment leaks. In addition, Oxy uses an event-driven process to assess, address, track, and (if applicable) quantify the mass of CO_2 Surface Leakage. The Subpart W report and results from any event-driven quantification will be reconciled to ensure that emissions at the surface are not double-counted. Oxy applies subpart W to the entire SSAU and does not distinguish between CO_{2FI} and CO_{2FP}, as a result, CO_{2FI} will contain all subpart W emissions for SSAU and CO_{2FP} will be reported as "0."

6.2 Detection and Quantification of CO_2 Surface Leakage

Oxy uses a multi-layered, risk-based monitoring program for event-driven incidents designed to meet two objectives: 1) to detect problems before CO_2 is emitted by Surface Leakage; and 2) to detect and quantify any CO_2 Surface Leakage that does occur. This section discusses how this monitoring will be conducted and used to quantify the mass of CO_2 Surface Leakage.

6.2.1 Monitoring Potential CO_2 Emissions 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 CO_2 Surface Leakage from the subsurface.

Reservoir simulation modeling, confirmed with 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 CO_2 emissions by Surface Leakage may be occurring. Excursions are not necessarily indicators of Surface Leakage; 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 CO_2 Surface 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 record in the computerized maintenance management system (CMMS). This record enables the tracking of progress on investigating potential leaks and, if CO_2 has been emitted by Surface Leakage, to quantify its magnitude.

Likewise, a forecast of the rate and composition of produced fluids is developed using the reservoir simulation model. Each producer well is assigned to a specific SAT and is isolated during each cycle for a well production test. The data from the test results are 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 will be initiated. As in the case of injection pattern monitoring, if the investigation leads to a work order in the CMMS, this record will provide the basis for tracking the outcome of the investigation and if a leak has occurred, recording the quantity Surface Leakage. If a CO_2 release in the flood zone were detected, an investigation would be conducted that would include an appropriate method to quantify the mass of any CO_2 confirmed to have been emitted by Surface Leakage. This might include use of material balance equations based on known injected quantities and monitored pressures in the injection zone to estimate the mass of CO_2 involved.

Generally, it is highly unlikely that a subsurface release at SSAU will lead to CO_2 Surface Leakage. In the unlikely event that there are indications of a potential subsurface release, Oxy would determine the appropriate approach for tracking subsurface release to determine whether there was a risk of CO_2 Surface Leakage, address and remedy the release and quantify any actual CO_2 Surface Leakage. To quantify CO_2 Surface Leakage, the relevant parameters (e.g., the rate, concentration, and duration of CO_2 Surface Leakage) would be either be directly measured or estimated to quantify the release mass. Depending on specific circumstances, these determinations may rely on engineering estimates.

In the event a release from the subsurface occurred diffusely through the seals to the surface, the CO_2 Surface Leakage would necessarily include H_2S, which is also present in the SSAU, which would trigger the alarm on the personal monitors worn by field personnel. CO_2 Leakage from the subsurface to the surface have not occurred in the SSAU. If CO_2 Surface Leakage was detected, personnel would use modeling, engineering estimates, and direct measurements to assess, address, and quantify the mass of CO_2 Surface Leakage.

6.2.2. Monitoring of Wellbores

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

CO_2 Surface Leakage from wellbores would be detected through the follow-up investigation of pressure anomalies, visual inspection, or the use of personal H_2S monitors.

Anomalies in injection zone pressure may not indicate CO_2 Surface Leakage. However, if an investigation leads to a work order, field personnel would inspect the equipment in question and determine the nature of the problem. Where possible, repairs will be made with materials on hand and the mass of CO_2 Surface Leakage would be included in the 40 CFR Part §98 Subpart W report for the SSAU. If repairs require additional time and materials, the appropriate approach for quantifying mass of CO_2 Surface Leakage using the relevant parameters (e.g., the rate, concentration, and duration) 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 any identified issues. Where possible, repairs will be made with materials on hand at the time of inspection and the mass of CO_2 Surface Leakage would be included in the 40 CFR Part §98 Subpart W report for SSAU. If repairs require additional time and materials, the affected well would be shut in, a work order would be generated, and the appropriate approach for quantifying the mass of CO_2 Surface Leakage using the relevant parameters (e.g., the rate, concentration, and duration) would be determined. The work order would serve as the basis for tracking the event for GHG reporting.

Because a CO_2 release 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 SSAU is employed to detect unexpected releases from wellbores and surface facilities. 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 CO_2 emissions.

Finally, the data collected by the H_2S monitors, which are worn by all field personnel at all times, are used as an additional method to detect CO_2 Surface Leakage from wellbores. The H_2S monitors' detection limit is 10 ppm; if an H_2S 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, H_2S is considered a proxy for potential CO_2 Surface Leakage in the field; thus, detected H_2S will be investigated to determine any if confirmed CO_2 Surface Leakage is occurring. If the incident results in a work order, this will serve as the basis for tracking the event for GHG reporting.

6.2.3. Other Potential CO_2 Emissions by Surface Leakage

The same visual inspection process and H_2S monitoring system for identifying potential CO_2 Surface Leakage s from wellbores will be used to detect other potential CO_2 Surface Leakage. Routine visual inspections are used to detect CO_2 Surface Leakage. 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 conducting a general observation of the facility for visible CO_2 emissions. If problems are detected, field personnel would investigate, and, if maintenance is required, generate a work order in the CMMS, which is tracked through completion. In addition to these visual inspections, the results of the personal H_2S monitors worn by field personnel will be used as a supplement to identify CO_2 Surface Leakage that may escape visual detection.

If CO_2 Surface Leakage are detected, they will be reported to surface operations personnel, who will review the reports and conduct a site investigation. If maintenance is required, steps will be taken to prevent further emissions, and a work order will be generated in the CMMS. The work order will describe the appropriate corrective action and be used to track completion of the maintenance action. It will also serve as the basis for tracking the event for GHG reporting and quantifying the mass of CO_2 Surface Leakage.

6.3. Monitoring to Demonstrate that Injected CO_2 Is Not Expected to Migrate to the Surface

At the end of the specified period, Oxy will cease injecting CO_2 for the subsidiary purpose of establishing the long-term storage of CO_2 in the SSAU. 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 CO_2 reported under 40 CFR §98.440-449 (Subpart RR) is not expected to migrate in the future in a manner likely to result in CO_2 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:

- Data comparing actual performance to predicted performance (purchase, injection, production) over the monitoring period;
- An assessment of the CO_2 Surface Leakage detected, including discussion of the estimated mass of CO_2 emitted and the distribution of emissions by Surface Leakage pathway;
- A demonstration that future operations will not release the injected CO_2 to the surface;
- A demonstration that there has been no significant CO_2 emissions by Surface Leakage and,
- An evaluation of reservoir pressure that demonstrates that injected fluids are not expected to migrate in a manner to likely to result in Surface Leakage.

7. Determination of Baselines

Existing automatic data systems will be utilized to identify and investigate excursions from expected performance that could indicate CO_2 emissions from the SSAU. Data systems are used primarily for operational control and monitoring and thus 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 CO_2 Surface Leakage will be developed. The following describes the approach to collecting this information.

7.1 Visual Inspections

As field personnel conduct routine inspections, work orders are generated in the CMMS for maintenance activities that cannot be addressed on the spot. Methods to capture work orders that involve activities that could potentially involve CO_2 Surface 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 mass of CO_2 Surface Leakage. Records of information used to calculate emissions will be maintained on file for a minimum of three years.

7.2 Personal H_2S Monitors

Oxy's injection gas compositional analysis indicates H_2S is approximately 1% of the total injected fluid stream. H_2S monitors are worn by all field personnel. The H_2S monitors detect concentrations of H_2S up to 500 ppm in 0.1 ppm increments and will sound an alarm if the detection limit exceeds 10 ppm. If an H_2S 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 H_2S to be a proxy for identifying CO_2 Surface Leakage. The person responsible for MRV documentation will receive notice of all incidents where H_2S 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 of the mass of CO_2 confirmed emitted from any such incidents. Records of information to calculate emissions will be maintained on file for a minimum of three years.

7.3 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 reservoir modeling. The injection targets are programmed into the WAG satellite controllers. High and low set points are also programmed into the controllers, and flags are generated whenever statistically significant deviations from these 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 lead to CO_2 Surface Leakage. The person responsible for the MRV documentation will receive notice of excursions and related work orders that could potentially involve CO_2 Surface Leakage. The Annual Subpart RR Report will provide an estimate of the mass of CO_2 confirmed Surface Leakage. Records of information used to calculate emissions will be maintained on file for a minimum of three years.

7.4 Production Volumes and Compositions

A general forecast of production volumes and composition is developed and used to evaluate performance periodically and refine current and projected injection plans and the forecast. This information is used to make operational decisions, but it is not recorded in an automated data system. Sometimes, this review may result in the generation of a work order in the CMMS. The MRV plan implementation lead will review such work orders and identify those that could result in CO_2 Surface Leakage. Should such events occur, the mass of CO_2 confirmed Surface Leakage 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

This section describes how Oxy uses the equations in Subpart RR §98.443 to calculate the mass of CO_2 received using equations RR-2 and RR-3, the mass of CO_2 injected using equations RR-5 and RR-6, the amount of CO_2 produced using equations RR-8 and RR-9, the mass of CO_2 Surface Leakage using equation RR-10, and the mass of CO_2 sequestered using equation RR-11.

8.1 Mass of CO_2 Received

In accordance with §98.443, Equation RR-2 will be used to calculate the mass of CO_2 Received. In accordance with the requirements at Subpart RR §98.444(a), CO_2 will be measured at the custody transfer meter from the Permian Basin CO_2 pipeline delivery system (M2 on Figure 5). Because there is no redelivery of CO_2, $S_{r,p}$ will be zero ("0"). Quarterly CO_2 concentration will be taken from the gas measurement database. The volumetric flow at standard conditions will be multiplied by the CO_2 concentration and the density of CO_2 at standard conditions to determine net Annual Mass of CO_2 Received.

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

Where:

$CO_{2T,r}$ = Net annual mass of CO_2 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 CO_2 at standard conditions (metric tons per standard cubic meter), 0.0018682;

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

p = Quarter of the year; and

r = Receiving flow meters.

In accordance with §98.443, Equation RR-3 will be used to sum the mass of CO_2 received from all flow meters is calculated in the following equation.

$$CO_2 = \sum_{r=1}^{R} CO_{2T,r} \qquad \text{(Eq. RR-3)}$$

Where:

CO_2 = Total net annual mass of CO_2 received (metric tons).

$CO_{2T,r}$ = Net annual mass of CO_2 received through flow meter r (metric tons).

8.2 Mass of CO_2 Injected into the Subsurface

As described in Section 6.1.3, the amount of CO_2 injected is measured at M2 and M3. In accordance with §98.443, Equation RR-5 will be used to calculate the mass of CO_2 flowing through each of these meters. Quarterly CO_2 concentration will be taken from the gas measurement database. The volumetric flow at standard conditions will be multiplied by the CO_2 concentration and the density of CO_2 at standard conditions to determine net Annual Mass of CO_2 Received. Figure 5

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

Where:

$CO_{2,u}$ = Annual CO_2 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 CO_2 at standard conditions (metric tons per standard cubic meter), 0.0018682;

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

p = Quarter of the year; and

u = Flow meter.

In accordance with §98.443, Equation RR-6 will be used to calculate the total Mass of CO_2 Injected, which is the sum of the Mass of CO_2 from flow meters M2 and M3.

$$CO_{2I} = \sum_{u=1}^{U} CO_{2,u} \qquad \text{(Eq. RR-6)}$$

Where:

$CO_{2,u}$ = Annual CO_2 mass recycled (metric tons) as measured by flow meter u + Net annual mass of CO_2 received through flow meter r (metric tons).

8.3 Mass of CO_2 Produced

In accordance with §98.443, Equation RR-8 will be used the calculate the Mass of CO_2 Produced at flow meter M7 on Figure 5, as described in Section 6.1.4. Quarterly CO_2 concentration will be taken from the gas measurement database. The volumetric flow at standard conditions will be multiplied by the CO_2 concentration and the density of CO_2 at standard conditions to determine net Annual Mass of CO_2 Received.

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

Where:

CO_{2w} = Annual CO_2 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 CO_2 at standard conditions (metric tons per standard cubic meter), 0.0018682;

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

p = Quarter of the year; and

w = Separator.

In accordance with §98.443 Equation RR-9, Oxy will calculate the amount of CO_2 entrained in oil at the custody transfer meters for oil sales, M4.

$$CO_{2,p} = (1+X) * \sum_{w=1}^{W} CO_{2,w} \quad \text{(Eq. RR-9)}$$

Where:

$CO_{2,p}$ = Total annual CO_2 mass produced (metric tons) through all meters in the reporting year;

$CO_{2,w}$ = Annual CO_2 mass produced (metric tons) through meter w in the reporting year;

X = Entrained CO_2 in produced oil or other fluid divided by the CO_2 separated through all separators in the reporting year (weight percent CO_2, expressed as a decimal fraction);

w = Separator

8.4 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 events. Oxy is prepared to address the potential for CO_2 Surface Leakage in a variety of settings. Estimates of the mass of confirmed CO_2 Surface Leakage will depend on a number of site-specific factors including measurements, engineering estimates, and emission factors, depending on the source and nature of the CO_2 Surface Leakage.

The process for quantifying the mass of CO_2 Surface Leakage will entail using best engineering principles or emission factors. While it is not possible to predict in advance all the types of events that may lead to CO_2 Surface Leakage, some approaches for quantification are described in Sections 5.9 and 6. In the event CO_2 Surface Leakage is confirmed the mass of CO_2 Surface Leakage would be quantified and reported, and records that describe the methods used to estimate or measure the mass emitted 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 the mass of CO_2 Surface Leakage are not double-counted.

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

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

Where:

CO_{2E} = Total annual CO_2 mass emitted by Surface Leakage (metric tons) in the reporting year;

CO_{2x} = Annual CO_2 mass emitted (metric tons) at leakage pathway x in the reporting year; and

x = Leakage pathway.

8.5 Mass of CO_2 Sequestered in Subsurface Geologic Formation

In accordance with §98.443, Equation RR-11 will be used to calculate the Mass of CO_2 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:

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) net of CO_2 entrained (i.e., dissolved) in oil 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. As described in Section 6.1.1.5 above, CO_{2FI} will contain all subpart W emissions for SSAU and CO_{2FP} will be reported as "0."

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. As described in Section 6.1.5 above, CO_{2FI} will contain all subpart W emissions for SSAU and CO_{2FP} will be reported as "0".

8.6 Cumulative Mass of CO_2 Reported as Sequestered in Subsurface Geologic Formation

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

9. MRV Plan Implementation Schedule

This MRV plan will be implemented starting January 1, 2023. GHG reports are filed on March 31 of the year after the reporting year, and Oxy anticipates that the Annual Subpart RR Report will be filed at the same time. Oxy anticipates that the MRV program will be in effect during the specified period, during which time one of the operating purposes will be to establish long-term containment of a measurable quantity of CO_2 in subsurface geological formations at the SSAU. Oxy anticipates that it will be able to demonstrate that a quantifiable mass of CO_2 injected during the specified period will be stored such that it will not migrate in the future in a manner that likely to result in Surface Leakage. At the end of the specified period, 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:

10.1.1 CO_2 Received and Injected

- The quarterly flow rate of CO_2 received by pipeline is measured at the receiving custody transfer meters.
- The quarterly CO_2 flow rate for recycled CO_2 is measured at the flow meter located at the SGPP outlet.

10.1.2 CO_2 Produced

- The point of measurement for the quantity of CO_2 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 SGPP flow meter used to measure flow rate of the gas stream, and the CO_2 concentration of the sample will be measured.
- The quarterly flow rate of the produced gas is measured at the flow meters located at the SGPP inlet.

10.1.3 CO_2 Emissions from Equipment Leaks and Vented Emissions of CO_2

The mass of CO_2 emitted from equipment leaks and vented emissions are measured in conformance with the monitoring and QA/QC requirements specified in Subpart W of 40 CFR Part §98.

10.1.4 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 either industry standard practices or an appropriate standard method published by a consensus-based standards organization; and,
- Calibrated, when necessary, using National Institute of Standards and Technology (NIST) methods that are traceable.

10.1.5 Concentration of CO_2

CO_2 concentration is measured using an industry standard practice or an appropriate standard method. Further, all measured CO_2 has been converted to standard cubic meters at a temperature of 60°F 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 CO_2 received that is missing will be estimated using invoices or using a representative flow rate value from the nearest previous time period.
- A quarterly CO_2 concentration of a CO_2 stream received that is missing will be estimated using invoices or using a representative concentration value from the nearest previous time period.
- A quarterly quantity of CO_2 injected that is missing will be estimated using a representative quantity of CO_2 injected from the nearest previous period of time at a similar injection pressure.
- For any values associated with CO_2 emissions from equipment leaks and vented emissions of CO_2 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 will be followed.
- The quarterly quantity of CO_2 produced from subsurface geologic formations that is missing will be estimated using a representative quantity of CO_2 produced from the nearest previous period of time.

10.3 MRV Plan Revisions

Within 180 days of a material change to the monitoring and/or operational parameters of the CO_2 EOR operations in the SSAU that is not anticipated in this MRV plan, a change in UIC permit class, EPA notification of substantive errors in this MRV plan or monitoring report, or if Oxy chooses to revise this MRV plan, the MRV plan will be revised and submitted to the EPA Administrator 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 CO_2 received at standard conditions and operating conditions, operating temperature and pressure, and concentration of these streams.
- Quarterly records of produced CO_2, including volumetric flow at standard conditions and operating conditions, operating temperature and pressure, and concentration of these streams.
- Quarterly records of injected CO_2 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 CO_2 emitted by Surface Leakage.
- 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 flow meter used to measure injection quantity and the injection wellhead.
- 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 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

Table 4 presents the well name and number, API number, type, and status for active wells in SSAU 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 CO_2 gas.
  - INJ_WAG refers to wells that inject water and CO_2 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.

Table 4—SSAU Well Numbers, Types, and Status

The Well Name & Number, API Number, Well Type, and Well Status are all from OXYODS.MDMODS.Well_All. They include only Oxy Operated wells with a field name like SEMINOLE (SAN ANDRES).

Well Name & Number from OXYODS	API Number	Well Type	Well Status as of November 2022
SSAU-3901	42165000220000	INJ_WAG	ACTIVE
SSAU-1301	42165000230000	PROD_OIL	ACTIVE
SSAU-0701	42165000240000	PROD_OIL	ACTIVE
SSAU-3902	42165000250000	INJ_WAG	ACTIVE
SSAU-1302	42165000260000	INJ_WAG	ACTIVE
SSAU-0702	42165000270000	INJ_WAG	ACTIVE
SSAU-3903	42165000290000	PROD_OIL	P & A
SSAU-1303	42165000300000	PROD_OIL	TA
SSAU-0703	42165000310000	PROD_OIL	ACTIVE
SSAU-3904	42165000320000	PROD_OIL	ACTIVE
SSAU-1304	42165000330000	PROD_OIL	ACTIVE
SSAU-0704	42165000340000	PROD_OIL	P & A
SSAU-3905W	42165000350000	INJ_WAG	ACTIVE
SSAU-0705	42165000360000	PROD_OIL	ACTIVE
SSAU-3906	42165000370000	PROD_OIL	ACTIVE
SSAU-1306	42165000380000	INJ_WAG	ACTIVE
SSAU-0706	42165000390000	INJ_H2O	ACTIVE
SSAU-3907	42165000400000	PROD_OIL	ACTIVE
SSAU-0707	42165000410000	INJ_H2O	ACTIVE
SSAU-3908	42165000420000	INJ_WAG	ACTIVE
SSAU-1102	42165000520000	INJ_WAG	P & A
SSAU-1202	42165000650000	PROD_OIL	ACTIVE
SSAU-3602	42165000660000	PROD_OIL	TA
SSAU-4801	42165000670000	PROD_OIL	ACTIVE
SSAU-1201	42165000690000	INJ_H2O	P & A
SSAU-4302	42165000720000	PROD_OIL	ACTIVE
SSAU-4303W	42165000730000	INJ_WAG	ACTIVE
SSAU-4304	42165000740000	INJ_WAG	ACTIVE
SSAU-4305	42165000750000	INJ_WAG	ACTIVE
SSAU-4306	42165000760000	INJ_WAG	ACTIVE
SSAU-4307	42165000770000	INJ_WAG	ACTIVE
SSAU-4308	42165000780000	INJ_WAG	ACTIVE
SSAU-4309	42165000790000	PROD_OIL	TA
SSAU-0401	42165000820000	INJ_H2O	ACTIVE

SSAU-0501	42165000830000	INJ_H2O	ACTIVE
SSAU-0402	42165000840000	PROD_OIL	P & A
SSAU-0502	42165000850000	PROD_OIL	ACTIVE
SSAU-0801	42165000980000	PROD_OIL	ACTIVE
SSAU-3501W	42165000990000	INJ_H2O	TA
SSAU-3502	42165001000000	PROD_OIL	ACTIVE
SSAU-3503	42165001010000	INJ_WAG	ACTIVE
SSAU-3504	42165001020000	INJ_WAG	SHUT-IN
SSAU-3505	42165001030000	INJ_WAG	ACTIVE
SSAU-3506	42165001040000	PROD_OIL	TA
SSAU-3507W	42165001050000	INJ_WAG	ACTIVE
SSAU-3508	42165001060000	PROD_OIL	ACTIVE
SSAU-3509	42165001070000	INJ_WAG	SHUT-IN
SSAU-3510	42165001080000	INJ_WAG	TA
SSAU-3511	42165001090000	INJ_WAG	ACTIVE
SSAU-3512	42165001100000	PROD_OIL	P & A
SSAU-3513W	42165001110000	INJ_WAG	ACTIVE
SSAU-3514	42165001120000	INJ_WAG	ACTIVE
SSAU-3515	42165001130000	PROD_OIL	P & A
SSAU-3516	42165001140000	PROD_OIL	TA
SSAU-6401	42165001700000	PROD_OIL	ACTIVE
SSAU-6402	42165001710000	INJ_WAG	ACTIVE
SSAU-6403	42165001720000	PROD_OIL	ACTIVE
SSAU-6404	42165001730000	PROD_OIL	ACTIVE
SSAU-6405	42165001740000	PROD_OIL	ACTIVE
SSAU-6406W	42165001750000	INJ_H2O	TA
SSAU-6407	42165001760000	PROD_OIL	ACTIVE
SSAU-2401W	42165001880000	INJ_WAG	ACTIVE
SSAU-2402	42165001890000	PROD_OIL	ACTIVE
SSAU-2403	42165001900000	PROD_OIL	ACTIVE
SSAU-2404	42165001910000	INJ_WAG	ACTIVE
SSAU-6001	42165001920000	PROD_OIL	TA
SSAU-5301	42165001930000	INJ_WAG	ACTIVE
SSAU-5302	42165001940000	PROD_OIL	ACTIVE
SSAU-5303	42165001950000	PROD_OIL	ACTIVE
SSAU-5304W	42165001960000	INJ_WAG	ACTIVE
SSAU-5305	42165001970000	INJ_WAG	ACTIVE
SSAU-5306	42165001980000	PROD_OIL	ACTIVE
SSAU-5307	42165001990000	PROD_OIL	ACTIVE
SSAU-5308W	42165002000000	INJ_WAG	P & A
SSAU-2701	42165002040000	INJ_WAG	ACTIVE

SSAU-2702	42165002050000	PROD_OIL	ACTIVE
SSAU-2703W	42165002060000	INJ_WAG	ACTIVE
SSAU-2704W	42165002070000	INJ_WAG	ACTIVE
SSAU-2705	42165002080000	PROD_OIL	ACTIVE
SSAU-2706	42165002090000	PROD_OIL	ACTIVE
SSAU-2707	42165002160000	INJ_WAG	ACTIVE
SSAU-2708	42165002170000	PROD_OIL	ACTIVE
SSAU-0601	42165002270000	INJ_H2O	ACTIVE
SSAU-4001	42165002290000	PROD_OIL	P & A
SSAU-1401	42165002300000	PROD_OIL	ACTIVE
SSAU-3701	42165002310000	INJ_WAG	ACTIVE
SSAU-4002W	42165002320000	INJ_WAG	ACTIVE
SSAU-1402W	42165002330000	INJ_H2O	P & A
SSAU-3702	42165002340000	PROD_OIL	ACTIVE
SSAU-4003	42165002350000	INJ_H2O	P & A
SSAU-1403	42165002360000	INJ_WAG	ACTIVE
SSAU-4004	42165002370000	PROD_OIL	ACTIVE
SSAU-1404	42165002380000	PROD_OIL	ACTIVE
SSAU-4005	42165002390000	INJ_H2O	P & A
SSAU-1405	42165002400000	PROD_OIL	ACTIVE
SSAU-4006	42165002410000	PROD_OIL	ACTIVE
SSAU-1406	42165002420000	INJ_WAG	ACTIVE
SSAU-4007	42165002430000	PROD_OIL	INACTIVE
SSAU-1407	42165002440000	PROD_OIL	ACTIVE
SSAU-4008	42165002450000	INJ_WAG	ACTIVE
SSAU-1408	42165002460000	INJ_H2O	P & A
SSAU-3601	42165002520000	INJ_H2O	TA
SSAU-1504	42165002570000	PROD_OIL	ACTIVE
SSAU-1505W	42165002580000	INJ_WAG	P & A
SSAU-1506	42165002590000	INJ_WAG	ACTIVE
SSAU-1507	42165002600000	PROD_OIL	ACTIVE
SSAU-5901	42165002630000	PROD_OIL	ACTIVE
SSAU-5902	42165002640000	PROD_OIL	TA
SSAU-3801	42165002690000	INJ_WAG	INACTIVE
SSAU-3802	42165002700000	PROD_OIL	INACTIVE
SSAU-3803	42165002710000	PROD_OIL	P & A
SSAU-3804	42165002720000	PROD_OIL	ACTIVE
SSAU-3805	42165002730000	PROD_OIL	INACTIVE
SSAU-3806	42165002740000	INJ_H2O	ACTIVE
SSAU-1901	42165002800000	PROD_OIL	ACTIVE
SSAU-1902	42165002820000	INJ_WAG	ACTIVE

SSAU-1903	42165002830000	PROD_OIL	ACTIVE
SSAU-1904	42165002840000	PROD_OIL	ACTIVE
SSAU-1905A	42165002850000	PROD_OIL	ACTIVE
SSAU-3301	42165002920000	INJ_WAG	P & A
SSAU-3302	42165002930000	PROD_OIL	ACTIVE
SSAU-3303	42165002940000	INJ_WAG	INACTIVE
SSAU-3304	42165002950000	PROD_OIL	ACTIVE
SSAU-1801	42165003180000	INJ_WAG	ACTIVE
SSAU-1305	42165003400000	PROD_OIL	P & A
SSAU-6408	42165003410000	INJ_H2O	ACTIVE
SSAU-0201	42165003420000	PROD_OIL	TA
SSAU-0202	42165003430000	INJ_H2O	INACTIVE
SSAU-5101	42165003440000	INJ_WAG	ACTIVE
SSAU-5102	42165003450000	INJ_WAG	ACTIVE
SSAU-5103	42165003460000	PROD_OIL	ACTIVE
SSAU-1501	42165003620000	PROD_OIL	ACTIVE
SSAU-1502	42165003630000	INJ_WAG	ACTIVE
SSAU-1503	42165003690000	PROD_OIL	TA
SSAU-6301	42165003870000	PROD_OIL	ACTIVE
SSAU-6302	42165003880000	PROD_OIL	ACTIVE
SSAU-6303	42165003890000	PROD_OIL	ACTIVE
SSAU-6304	42165003900000	INJ_WAG	ACTIVE
SSAU-6305	42165003910000	INJ_H2O	ACTIVE
SSAU-6306	42165003920000	PROD_OIL	ACTIVE
SSAU-6307	42165003930000	INJ_H2O	ACTIVE
SSAU-6308	42165003940000	PROD_OIL	INACTIVE
SSAU-7301	42165004090000	PROD_OIL	ACTIVE
SSAU-7302	42165004100000	PROD_OIL	ACTIVE
SSAU-8201	42165004110000	PROD_OIL	INACTIVE
SSAU-8202	42165004120000	PROD_OIL	P & A
SSAU-8203	42165004130000	PROD_OIL	P & A
SSAU-7701	42165004140000	PROD_OIL	ACTIVE
SSAU-7702	42165004150000	INJ_H2O	ACTIVE
SSAU-8101	42165004160000	PROD_OIL	INACTIVE
SSAU-8102	42165004170000	PROD_OIL	ACTIVE
SSAU-8103	42165004180000	PROD_OIL	INACTIVE
SSAU-8104	42165004190000	INJ_H2O	ACTIVE
SSAU-7401W	42165004230000	INJ_H2O	P & A
SSAU-6101	42165004240000	PROD_OIL	ACTIVE
SSAU-4501	42165008710000	PROD_OIL	P & A
SSAU-8401	42165009570000	INJ_H2O	P & A

SSAU-5601	42165009880000	PROD_OIL	ACTIVE
SSAU-5602	42165009890000	PROD_OIL	P & A
SSAU-5603	42165009900000	PROD_OIL	P & A
SSAU-3001	42165011170000	PROD_OIL	INACTIVE
SSAU-0301	42165011180000	PROD_OIL	P & A
SSAU-3401W	42165011950000	INJ_WAG	ACTIVE
SSAU-3402	42165012040000	PROD_OIL	ACTIVE
SSAU-3403	42165012050000	PROD_OIL	ACTIVE
SSAU-3404	42165012060000	INJ_WAG	ACTIVE
SSAU-2807	42165012130000	PROD_OIL	ACTIVE
SSAU-2808	42165012140000	INJ_WAG	ACTIVE
SSAU-1601	42165012320000	INJ_WAG	ACTIVE
SSAU-1602	42165012330000	PROD_OIL	ACTIVE
SSAU-1603	42165012340000	PROD_OIL	ACTIVE
SSAU-1604	42165012350000	INJ_WAG	ACTIVE
SSAU-1605	42165012360000	PROD_OIL	ACTIVE
SSAU-1606W	42165012370000	INJ_WAG	ACTIVE
SSAU-1607	42165012380000	PROD_OIL	ACTIVE
SSAU-1608	42165012390000	INJ_WAG	ACTIVE
SSAU-2601	42165012430000	PROD_OIL	P & A
SSAU-2501	42165012770000	PROD_OIL	ACTIVE
SSAU-2801	42165012830000	PROD_OIL	P & A
SSAU-2802	42165012840000	INJ_WAG	SHUT-IN
SSAU-2803	42165012850000	PROD_OIL	ACTIVE
SSAU-2804	42165012860000	INJ_WAG	ACTIVE
SSAU-2805W	42165012870000	INJ_WAG	ACTIVE
SSAU-2806	42165012880000	PROD_OIL	ACTIVE
SSAU-0903	42165014280000	INJ_WAG	P & A
SSAU-0902	42165014290000	PROD_OIL	P & A
SSAU-0901W	42165014300000	INJ_WAG	P & A
SSAU-5701	42165014410000	PROD_OIL	P & A
SSAU-0101	42165015120000	INJ_H2O	TA
SSAU-2001	42165015590000	PROD_OIL	P & A
SSAU-0102	42165015620000	PROD_OIL	P & A
SSAU-2202	42165015770000	PROD_OIL	ACTIVE
SSAU-7512	42165015790000	PROD_OIL	P & A
SSAU-5516	42165015800000	INJ_WAG	ACTIVE
SSAU-4101	42165017730000	INJ_WAG	ACTIVE
SSAU-6501	42165017790000	PROD_OIL	P & A
SSAU-6502	42165017800000	INJ_H2O	P & A
SSAU-6503	42165017810000	PROD_OIL	P & A

SSAU-7501	42165017830000	PROD_OIL	ACTIVE
SSAU-7502	42165017840000	PROD_OIL	INACTIVE
SSAU-7503	42165017850000	PROD_OIL	P & A
SSAU-7504	42165017860000	PROD_OIL	ACTIVE
SSAU-7505	42165017870000	PROD_OIL	ACTIVE
SSAU-7506W	42165017880000	INJ_H2O	ACTIVE
SSAU-7507W	42165017890000	INJ_H2O	ACTIVE
SSAU-7508	42165017900000	PROD_OIL	ACTIVE
SSAU-7509	42165017910000	PROD_OIL	INACTIVE
SSAU-7510	42165017920000	PROD_OIL	ACTIVE
SSAU-7511	42165017930000	INJ_H2O	ACTIVE
SSAU-5501	42165017940000	PROD_OIL	ACTIVE
SSAU-5502	42165017950000	INJ_WAG	ACTIVE
SSAU-5503	42165017960000	PROD_OIL	P & A
SSAU-5504W	42165017970000	INJ_WAG	ACTIVE
SSAU-5505	42165017980000	PROD_OIL	P & A
SSAU-5506	42165017990000	INJ_WAG	ACTIVE
SSAU-5507	42165018000000	PROD_OIL	ACTIVE
SSAU-5508	42165018010000	INJ_WAG	ACTIVE
SSAU-5509	42165018020000	INJ_WAG	ACTIVE
SSAU-5510	42165018030000	PROD_OIL	ACTIVE
SSAU-5511W	42165018040000	INJ_WAG	ACTIVE
SSAU-5512	42165018050000	PROD_OIL	P & A
SSAU-5513	42165018060000	PROD_OIL	TA
SSAU-5514	42165018070000	PROD_OIL	P & A
SSAU-5515	42165018080000	PROD_OIL	P & A
SSAU-2901	42165018090000	PROD_OIL	ACTIVE
SSAU-2902	42165018100000	INJ_WAG	ACTIVE
SSAU-2903	42165018110000	PROD_OIL	P & A
SSAU-2904W	42165018120000	INJ_WAG	ACTIVE
SSAU-2905	42165018130000	INJ_WAG	SHUT-IN
SSAU-2906	42165018140000	INJ_WAG	ACTIVE
SSAU-2907	42165018150000	PROD_OIL	ACTIVE
SSAU-2908	42165018160000	INJ_WAG	ACTIVE
SSAU-2909	42165018170000	INJ_WAG	TA
SSAU-2910	42165018180000	PROD_OIL	ACTIVE
SSAU-2911	42165018190000	PROD_OIL	TA
SSAU-2912	42165018200000	PROD_OIL	ACTIVE
SSAU-2913W	42165018210000	INJ_H2O	INACTIVE
SSAU-2914	42165018220000	INJ_H2O	ACTIVE
SSAU-4102	42165018230000	PROD_OIL	ACTIVE

SSAU-4103	42165018240000	PROD_OIL	ACTIVE
SSAU-4104W	42165018250000	INJ_WAG	ACTIVE
SSAU-4105	42165018260000	PROD_OIL	ACTIVE
SSAU-4106	42165018270000	PROD_OIL	TA
SSAU-4107	42165018280000	INJ_WAG	ACTIVE
SSAU-4108W	42165018290000	INJ_WAG	ACTIVE
SSAU-4109	42165018300000	PROD_OIL	ACTIVE
SSAU-4110	42165018310000	INJ_WAG	ACTIVE
SSAU-4111	42165018320000	PROD_OIL	ACTIVE
SSAU-4114	42165018330000	INJ_WAG	ACTIVE
SSAU-4116	42165018340000	INJ_WAG	ACTIVE
SSAU-4115	42165018350000	PROD_OIL	ACTIVE
SSAU-4112	42165018360000	INJ_WAG	ACTIVE
SSAU-4113	42165018370000	PROD_OIL	P & A
SSAU-6201	42165018380000	INJ_WAG	ACTIVE
SSAU-6202	42165018390000	PROD_OIL	ACTIVE
SSAU-6203	42165018400000	INJ_WAG	ACTIVE
SSAU-6204	42165018410000	INJ_H2O	ACTIVE
SSAU-6205	42165018420000	PROD_OIL	ACTIVE
SSAU-6206	42165018430000	PROD_OIL	ACTIVE
SSAU-6208	42165018440000	PROD_OIL	P & A
SSAU-6209	42165018450000	INJ_H2O	ACTIVE
SSAU-6210	42165018460000	PROD_OIL	ACTIVE
SSAU-3101	42165018470000	PROD_OIL	ACTIVE
SSAU-3102	42165018480000	INJ_WAG	ACTIVE
SSAU-3103	42165018490000	PROD_OIL	ACTIVE
SSAU-3107	42165018510000	INJ_WAG	P & A
SSAU-3108	42165018520000	PROD_OIL	ACTIVE
SSAU-3109	42165018530000	PROD_OIL	ACTIVE
SSAU-3110	42165018540000	INJ_H2O	ACTIVE
SSAU-3111	42165018550000	PROD_OIL	ACTIVE
SSAU-3106	42165018560000	INJ_WAG	ACTIVE
SSAU-2204	42165018570000	PROD_OIL	ACTIVE
SSAU-2201	42165018580000	INJ_WAG	ACTIVE
SSAU-2203	42165018590000	INJ_WAG	ACTIVE
SSAU-2205	42165018600000	PROD_OIL	P & A
SSAU-2206	42165018610000	PROD_OIL	ACTIVE
SSAU-2208	42165018620000	INJ_WAG	ACTIVE
SSAU-2207	42165018630000	PROD_OIL	INACTIVE
SSAU-2209	42165018640000	PROD_OIL	ACTIVE
SSAU-2210	42165018650000	INJ_WAG	ACTIVE

SSAU-2211	42165018660000	PROD_OIL	ACTIVE
SSAU-3104	42165018730000	INJ_H2O	P & A
SSAU-6207	42165018740000	PROD_OIL	ACTIVE
SSAU-7601	42165018800000	PROD_OIL	ACTIVE
SSAU-7602	42165018810000	PROD_OIL	ACTIVE
SSAU-7603	42165018820000	INJ_H2O	TA
SSAU-7604	42165018830000	PROD_OIL	P & A
SSAU-7001	42165018870000	PROD_OIL	ACTIVE
SSAU-4901	42165020110000	PROD_OIL	ACTIVE
SSAU-4902	42165020120000	PROD_OIL	P & A
SSAU-4903	42165020130000	PROD_OIL	ACTIVE
SSAU-4904	42165020140000	INJ_WAG	ACTIVE
SSAU-4905	42165020150000	PROD_OIL	ACTIVE
SSAU-3201	42165020170000	PROD_OIL	P & A
SSAU-3202	42165020180000	INJ_WAG	INACTIVE
SSAU-3203	42165020190000	PROD_OIL	ACTIVE
SSAU-3204	42165020200000	INJ_WAG	ACTIVE
SSAU-3205	42165020210000	PROD_OIL	TA
SSAU-3206	42165020220000	INJ_WAG	ACTIVE
SSAU-3207	42165020230000	PROD_OIL	ACTIVE
SSAU-3208	42165020240000	INJ_WAG	ACTIVE
SSAU-2301	42165020250000	PROD_OIL	ACTIVE
SSAU-2302	42165020260000	INJ_WAG	ACTIVE
SSAU-2303	42165020270000	PROD_OIL	INACTIVE
SSAU-2304W	42165020280000	INJ_WAG	P & A
SSAU-2305	42165020290000	PROD_OIL	ACTIVE
SSAU-2306	42165020300000	INJ_WAG	ACTIVE
SSAU-2307	42165020310000	PROD_OIL	ACTIVE
SSAU-2308	42165020320000	INJ_WAG	ACTIVE
SSAU-2101	42165020630000	PROD_OIL	ACTIVE
SSAU-1701	42165020650000	PROD_OIL	ACTIVE
SSAU-1702	42165020660000	PROD_OIL	ACTIVE
SSAU-1101	42165020680000	PROD_OIL	ACTIVE
SSAU-1001	42165020690000	PROD_OIL	ACTIVE
SSAU-1002W	42165020700000	INJ_WAG	ACTIVE
SSAU-1003	42165020710000	INJ_WAG	ACTIVE
SSAU-1004	42165020720000	PROD_OIL	ACTIVE
SSAU-1005	42165020730000	PROD_OIL	ACTIVE
SSAU-1006W	42165020740000	INJ_WAG	ACTIVE
SSAU-1007	42165020750000	PROD_OIL	ACTIVE
SSAU-1008	42165020760000	INJ_WAG	ACTIVE

SSAU-1009	42165020770000	PROD_OIL	ACTIVE
SSAU-1010	42165020790000	INJ_WAG	ACTIVE
SSAU-5201A	42165024290000	PROD_OIL	ACTIVE
SSAU-5202	42165024300000	INJ_WAG	ACTIVE
SSAU-5203	42165024310000	PROD_OIL	P & A
SSAU-5204A	42165024330000	INJ_WAG	ACTIVE
SSAU-5401	42165025670000	PROD_OIL	ACTIVE
SSAU-5402	42165025680000	PROD_OIL	ACTIVE
SSAU-5403	42165025690000	INJ_WAG	P & A
SSAU-5404W	42165025700000	INJ_WAG	ACTIVE
SSAU-4201	42165025740000	INJ_WAG	P & A
SSAU-4202	42165025750000	PROD_OIL	TA
SSAU-4203	42165025760000	INJ_WAG	P & A
SSAU-4204	42165025770000	INJ_WAG	ACTIVE
SSAU-7513	42165025950000	PROD_OIL	P & A
SSAU-3105A	42165025990000	PROD_OIL	P & A
SSAU-2602A	42165028350000	INJ_WAG	ACTIVE
SSAU-2502	42165028520000	INJ_WAG	ACTIVE
SSAU-5801	42165032350000	PROD_OIL	TA
SSAU-5702	42165032360000	PROD_OIL	P & A
SSAU-5704	42165032380000	PROD_OIL	TA
SSAU-5705	42165032390000	INJ_H2O	P & A
SSAU-6901	42165032410000	PROD_OIL	P & A
SSAU-7201	42165033030000	PROD_OIL	ACTIVE
SSAU-5001A	42165033170000	INJ_WAG	ACTIVE
SSAU-2214	42165100130000	PROD_OIL	ACTIVE
SSAU-2603	42165100340000	PROD_OIL	ACTIVE
SSAU-4310	42165100700000	PROD_OIL	P & A
SSAU-1508	42165100770000	PROD_OIL	P & A
SSAU-3703	42165101260000	PROD_OIL	P & A
SSAU-3209	42165101610000	PROD_OIL	ACTIVE
SSAU-1906	42165101920000	PROD_OIL	P & A
SSAU-4311	42165101990000	PROD_OIL	ACTIVE
SSAU-4312	42165102000000	PROD_OIL	TA
SSAU-0503	42165102010000	INJ_H2O	P & A
SSAU-3114W	42165106050000	INJ_H2O	P & A
SSAU-3113	42165106300000	PROD_OIL	P & A
SSAU-6211	42165300130000	INJ_H2O	ACTIVE
SSAU-3807	42165300140000	INJ_H2O	P & A
SSAU-3704	42165300150000	INJ_H2O	ACTIVE
SSAU-0403	42165300160000	INJ_H2O	P & A

SSAU-6212	42165300170000	INJ_H2O	ACTIVE
SSAU-7202	42165300180000	INJ_H2O	INACTIVE
SSAU-4907	42165300540000	INJ_H2O	ACTIVE
SSAU-2213	42165300550000	INJ_H2O	TA
SSAU-0303	42165300560000	INJ_H2O	P & A
SSAU-0603	42165300570000	INJ_H2O	ACTIVE
SSAU-4602	42165301250000	INJ_H2O	TA
SSAU-4401	42165301260000	INJ_H2O	ACTIVE
SSAU-2003	42165301270000	INJ_H2O	INACTIVE
SSAU-1907	42165301280000	INJ_H2O	P & A
SSAU-1802	42165301290000	INJ_H2O	TA
SSAU-4802	42165301300000	INJ_H2O	TA
SSAU-8204	42165301310000	INJ_H2O	TA
SSAU-3105R	42165303490000	PROD_OIL	P & A
SSAU-5514R	42165304820000	INJ_WAG	ACTIVE
SSAU-7514	42165304840000	INJ_H2O	ACTIVE
SSAU-1803	42165304850000	INJ_H2O	ACTIVE
SSAU-2915	42165304890000	PROD_OIL	ACTIVE
SSAU-2405	42165305540000	INJ_WAG	ACTIVE
SSAU-3910	42165305550000	PROD_OIL	P & A
SSAU-2406	42165305660000	PROD_OIL	ACTIVE
SSAU-2505	42165305670000	PROD_OIL	TA
SSAU-2504	42165305680000	INJ_WAG	ACTIVE
SSAU-2310	42165311550000	PROD_OIL	ACTIVE
SSAU-4902R	42165311560000	INJ_WAG	ACTIVE
SSAU-2710	42165311570000	INJ_WAG	ACTIVE
SSAU-2810	42165311580000	PROD_OIL	ACTIVE
SSAU-2809	42165311590000	INJ_WAG	ACTIVE
SSAU-2309	42165311600000	PROD_OIL	ACTIVE
SSAU-2312	42165311610000	PROD_OIL	ACTIVE
SSAU-2311	42165311620000	INJ_WAG	ACTIVE
SSAU-2709	42165311760000	PROD_OIL	ACTIVE
SSAU-3119	42165312170000	PROD_OIL	ACTIVE
SSAU-2218	42165312530000	INJ_WAG	ACTIVE
SSAU-2219	42165312540000	PROD_OIL	ACTIVE
SSAU-2217	42165312550000	INJ_WAG	ACTIVE
SSAU-2216	42165312560000	PROD_OIL	ACTIVE
SSAU-2712	42165312640000	INJ_WAG	ACTIVE
SSAU-2711	42165312650000	PROD_OIL	ACTIVE
SSAU-2811	42165312660000	INJ_WAG	ACTIVE
SSAU-2812	42165312670000	PROD_OIL	ACTIVE

SSAU-3116	42165313540000	INJ_WAG	ACTIVE
SSAU-3306	42165313640000	INJ_WAG	ACTIVE
SSAU-3210	42165313650000	PROD_OIL	ACTIVE
SSAU-3305	42165313660000	PROD_OIL	ACTIVE
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SSAU-3213	42165313720000	INJ_WAG	ACTIVE
SSAU-3212	42165313730000	PROD_OIL	ACTIVE
SSAU-3519	42165313780000	INJ_WAG	ACTIVE
SSAU-3406	42165313790000	INJ_WAG	ACTIVE
SSAU-3517	42165313800000	INJ_WAG	ACTIVE
SSAU-3405	42165313810000	PROD_OIL	ACTIVE
SSAU-3520	42165313820000	PROD_OIL	P & A
SSAU-3118	42165313830000	INJ_WAG	ACTIVE
SSAU-2220	42165313840000	INJ_WAG	ACTIVE
SSAU-3518	42165313850000	PROD_OIL	ACTIVE
SSAU-3117	42165313860000	PROD_OIL	ACTIVE
SSAU-3115	42165314520000	PROD_OIL	ACTIVE
SSAU-3521	42165314660000	INJ_WAG	ACTIVE
SSAU-4313	42165318840000	PROD_OIL	ACTIVE
SSAU-4314	42165318850000	PROD_OIL	P & A
SSAU-4119	42165318860000	INJ_WAG	ACTIVE
SSAU-4315	42165318870000	PROD_OIL	ACTIVE
SSAU-4117	42165318880000	INJ_WAG	ACTIVE
SSAU-4118	42165318890000	PROD_OIL	P & A
SSAU-4011	42165318920000	INJ_WAG	ACTIVE
SSAU-4009	42165318930000	PROD_OIL	ACTIVE
SSAU-0708	42165319020000	PROD_OIL	ACTIVE
SSAU-0709	42165319030000	PROD_OIL	ACTIVE
SSAU-0904	42165319040000	PROD_OIL	ACTIVE
SSAU-1103	42165319050000	PROD_OIL	ACTIVE
SSAU-1308	42165319060000	PROD_OIL	ACTIVE
SSAU-1512	42165319070000	PROD_OIL	TA
SSAU-1511	42165319080000	PROD_OIL	ACTIVE
SSAU-1307	42165319090000	PROD_OIL	ACTIVE
SSAU-1510	42165319100000	PROD_OIL	ACTIVE
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SSAU-4010	42165319210000	PROD_OIL	ACTIVE
SSAU-4012	42165319220000	PROD_OIL	ACTIVE
SSAU-4015	42165319250000	INJ_WAG	ACTIVE
SSAU-4120	42165319260000	PROD_OIL	ACTIVE
SSAU-4121	42165319270000	INJ_WAG	ACTIVE

SSAU-4122	42165319280000	PROD_OIL	ACTIVE
SSAU-4316	42165319290000	PROD_OIL	ACTIVE
SSAU-4317	42165319300000	PROD_OIL	ACTIVE
SSAU-4318	42165319310000	PROD_OIL	P & A
SSAU-4319	42165319320000	PROD_OIL	INACTIVE
SSAU-4320	42165319330000	PROD_OIL	ACTIVE
SSAU-4908	42165319340000	PROD_OIL	ACTIVE
SSAU-1011	42165319350000	PROD_OIL	TA
SSAU-0802	42165319360000	PROD_OIL	ACTIVE
SSAU-1203	42165319430000	PROD_OIL	ACTIVE
SSAU-4123	42165319900000	INJ_WAG	ACTIVE
SSAU-4322	42165319910000	PROD_OIL	P & A
SSAU-4205	42165319920000	PROD_OIL	INACTIVE
SSAU-4126	42165319930000	PROD_OIL	ACTIVE
SSAU-1310	42165320070000	PROD_OIL	ACTIVE
SSAU-4018	42165320080000	INJ_WAG	ACTIVE
SSAU-4019	42165320090000	PROD_OIL	ACTIVE
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SSAU-1516	42165320150000	PROD_OIL	ACTIVE
SSAU-1612	42165320170000	PROD_OIL	ACTIVE
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SSAU-1409	42165320210000	PROD_OIL	ACTIVE
SSAU-1410	42165320220000	PROD_OIL	ACTIVE
SSAU-1513	42165320260000	PROD_OIL	ACTIVE
SSAU-1412	42165320270000	PROD_OIL	ACTIVE
SSAU-1309	42165320280000	PROD_OIL	ACTIVE
SSAU-1015	42165320290000	PROD_OIL	ACTIVE
SSAU-1014	42165320300000	PROD_OIL	ACTIVE
SSAU-1012	42165320310000	PROD_OIL	ACTIVE
SSAU-0905	42165320320000	PROD_OIL	ACTIVE
SSAU-0710	42165320330000	PROD_OIL	ACTIVE
SSAU-4124	42165320340000	PROD_OIL	ACTIVE
SSAU-1909	42165320350000	INJ_WAG	ACTIVE
SSAU-1614	42165320360000	INJ_WAG	ACTIVE
SSAU-1611	42165320370000	PROD_OIL	ACTIVE
SSAU-1609	42165320380000	PROD_OIL	ACTIVE
SSAU-1514	42165320390000	PROD_OIL	ACTIVE
SSAU-1411	42165320410000	PROD_OIL	ACTIVE
SSAU-1515	42165320420000	PROD_OIL	ACTIVE
SSAU-1016	42165320430000	PROD_OIL	ACTIVE
SSAU-1013	42165320440000	PROD_OIL	ACTIVE

SSAU-0906	42165320450000	PROD_OIL	ACTIVE
SSAU-1615	42165320460000	PROD_OIL	ACTIVE
SSAU-1613	42165320470000	PROD_OIL	ACTIVE
SSAU-1610	42165320480000	PROD_OIL	TA
SSAU-2226	42165320530000	PROD_OIL	ACTIVE
SSAU-2221	42165320560000	PROD_OIL	ACTIVE
SSAU-1908	42165320570000	PROD_OIL	ACTIVE
SSAU-2222	42165320770000	PROD_OIL	ACTIVE
SSAU-1017	42165320940000	PROD_OIL	ACTIVE
SSAU-4125	42165320950000	PROD_OIL	P & A
SSAU-4127	42165321050000	PROD_OIL	ACTIVE
SSAU-4130	42165321060000	PROD_OIL	ACTIVE
SSAU-4129	42165321070000	PROD_OIL	ACTIVE
SSAU-4128	42165321080000	INJ_WAG	ACTIVE
SSAU-2916	42165321240000	PROD_OIL	ACTIVE
SSAU-2918	42165321270000	PROD_OIL	ACTIVE
SSAU-2917	42165321280000	INJ_WAG	ACTIVE
SSAU-2919	42165321300000	PROD_OIL	ACTIVE
SSAU-3522	42165321320000	PROD_OIL	ACTIVE
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SSAU-3531	42165321400000	INJ_WAG	ACTIVE
SSAU-3529	42165321410000	PROD_OIL	ACTIVE
SSAU-3407	42165321420000	PROD_OIL	ACTIVE
SSAU-2228	42165322070000	INJ_WAG	ACTIVE
SSAU-2801R	42165325930000	INJ_WAG	ACTIVE
SSAU-3215	42165326730000	PROD_OIL	ACTIVE
SSAU-3121	42165326740000	PROD_OIL	ACTIVE
SSAU-3120	42165326750000	INJ_WAG	ACTIVE
SSAU-2315	42165326760000	INJ_WAG	ACTIVE
SSAU-3216	42165326790000	INJ_WAG	ACTIVE
SSAU-3705	42165327310000	PROD_OIL	ACTIVE
SSAU-3528	42165327340000	PROD_OIL	TA
SSAU-3218	42165327350000	INJ_WAG	ACTIVE
SSAU-2820	42165327410000	PROD_OIL	ACTIVE
SSAU-2920	42165327430000	INJ_WAG	ACTIVE
SSAU-2921	42165327440000	PROD_OIL	P & A

SSAU-3122	42165327510000	PROD_OIL	ACTIVE
SSAU-2818	42165327520000	PROD_OIL	ACTIVE
SSAU-2316	42165327530000	PROD_OIL	ACTIVE
SSAU-3219	42165327540000	INJ_WAG	ACTIVE
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SSAU-2604	42165327560000	INJ_WAG	ACTIVE
SSAU-2814	42165327760000	INJ_WAG	ACTIVE
SSAU-2816	42165327770000	INJ_WAG	ACTIVE
SSAU-2815	42165327780000	PROD_OIL	ACTIVE
SSAU-2506	42165327790000	PROD_OIL	ACTIVE
SSAU-2314	42165327800000	INJ_WAG	ACTIVE
SSAU-2813	42165327960000	PROD_OIL	ACTIVE
SSAU-2507	42165327970000	INJ_WAG	ACTIVE
SSAU-2317	42165327980000	PROD_OIL	P & A
SSAU-3916	42165328250000	PROD_OIL	ACTIVE
SSAU-1019	42165328260000	INJ_WAG	ACTIVE
SSAU-2407	42165328270000	INJ_WAG	ACTIVE
SSAU-1018	42165328280000	PROD_OIL	ACTIVE
SSAU-2714	42165328290000	INJ_WAG	ACTIVE
SSAU-3915	42165328310000	INJ_WAG	ACTIVE
SSAU-2225	42165328620000	PROD_OIL	ACTIVE
SSAU-3917	42165328630000	PROD_OIL	ACTIVE
SSAU-3408	42165328640000	INJ_WAG	ACTIVE
SSAU-2313	42165328650000	INJ_WAG	ACTIVE
SSAU-3533	42165328660000	PROD_OIL	ACTIVE
SSAU-2713	42165328670000	PROD_OIL	ACTIVE
SSAU-4131	42165328680000	PROD_OIL	ACTIVE
SSAU-3911	42165328730000	PROD_OIL	ACTIVE
SSAU-3912	42165328750000	PROD_OIL	P & A
SSAU-4016	42165328760000	PROD_OIL	ACTIVE
SSAU-4323	42165328770000	PROD_OIL	ACTIVE
SSAU-3913	42165328780000	INJ_WAG	ACTIVE
SSAU-4208	42165328800000	INJ_WAG	ACTIVE
SSAU-4017	42165328810000	PROD_OIL	ACTIVE
SSAU-3914	42165328910000	PROD_OIL	INACTIVE
SSAU-4207	42165328920000	PROD_OIL	P & A
SSAU-4206	42165328930000	PROD_OIL	ACTIVE
SSAU-4014	42165329030000	PROD_OIL	ACTIVE
SSAU-4020	42165329040000	PROD_OIL	ACTIVE
SSAU-4013A	42165329070000	INJ_WAG	ACTIVE
SSAU-4909	42165330350000	PROD_OIL	ACTIVE

SSAU-5104	42165330360000	PROD_OIL	ACTIVE
SSAU-5106	42165330670000	INJ_WAG	ACTIVE
SSAU-3201R	42165330680000	PROD_OIL	ACTIVE
SSAU-5206	42165330690000	PROD_OIL	ACTIVE
SSAU-3530	42165330900000	PROD_OIL	ACTIVE
SSAU-5207	42165331060000	INJ_WAG	ACTIVE
SSAU-5107	42165331070000	PROD_OIL	ACTIVE
SSAU-1303R	42165331210000	INJ_WAG	ACTIVE
SSAU-5310	42165331220000	INJ_WAG	ACTIVE
SSAU-5517	42165331230000	INJ_WAG	ACTIVE
SSAU-5105	42165331240000	PROD_OIL	ACTIVE
SSAU-3912R	42165331250000	PROD_OIL	ACTIVE
SSAU-5209	42165331260000	INJ_WAG	ACTIVE
SSAU-5309	42165331310000	PROD_OIL	ACTIVE
SSAU-5518	42165331480000	PROD_OIL	ACTIVE
SSAU-5523	42165331490000	PROD_OIL	ACTIVE
SSAU-5520	42165331500000	PROD_OIL	ACTIVE
SSAU-5524	42165331510000	INJ_WAG	ACTIVE
SSAU-5519	42165331520000	INJ_WAG	ACTIVE
SSAU-5521	42165331530000	PROD_OIL	ACTIVE
SSAU-5210	42165331540000	PROD_OIL	ACTIVE
SSAU-5522	42165331550000	INJ_WAG	ACTIVE
SSAU-5529	42165331910000	PROD_OIL	ACTIVE
SSAU-5406	42165331920000	PROD_OIL	ACTIVE
SSAU-5528	42165331930000	PROD_OIL	ACTIVE
SSAU-5530	42165331940000	PROD_OIL	TA
SSAU-5531	42165331950000	PROD_OIL	ACTIVE
SSAU-5407	42165331960000	INJ_WAG	ACTIVE
SSAU-5409	42165331970000	PROD_OIL	ACTIVE
SSAU-5312	42165331980000	INJ_WAG	ACTIVE
SSAU-5108	42165332090000	PROD_OIL	INACTIVE
SSAU-5311	42165332180000	PROD_OIL	ACTIVE
SSAU-5525	42165332210000	PROD_OIL	ACTIVE
SSAU-5527	42165332220000	PROD_OIL	ACTIVE
SSAU-5408	42165332230000	INJ_WAG	ACTIVE
SSAU-6310	42165332250000	PROD_OIL	ACTIVE
SSAU-5526	42165332260000	INJ_WAG	ACTIVE
SSAU-6309	42165332270000	PROD_OIL	ACTIVE
SSAU-6504	42165332280000	PROD_OIL	ACTIVE
SSAU-6412	42165332290000	PROD_OIL	ACTIVE
SSAU-6409	42165332300000	PROD_OIL	TA

SSAU-6411	42165332310000	PROD_OIL	TA
SSAU-6312	42165332320000	PROD_OIL	ACTIVE
SSAU-6311	42165332350000	PROD_OIL	ACTIVE
SSAU-6213	42165332360000	PROD_OIL	TA
SSAU-5313	42165332410000	INJ_WAG	ACTIVE
SSAU-5405	42165332420000	PROD_OIL	ACTIVE
SSAU-6505	42165332430000	PROD_OIL	INACTIVE
SSAU-1408R	42165333580000	INJ_WAG	ACTIVE
SSAU-6313	42165334080000	PROD_OIL	INACTIVE
SSAU-7203	42165334180000	PROD_OIL	INACTIVE
SSAU-6215	42165334640000	PROD_OIL	TA
SSAU-4301R	42165334810000	INJ_WAG	ACTIVE
SSAU-6410	42165335190000	PROD_OIL	ACTIVE
SSAU-2304R	42165337570000	INJ_WAG	ACTIVE
SSAU-1201R	42165337580000	INJ_WAG	ACTIVE
SSAU-4003R	42165337590000	INJ_WAG	ACTIVE
SSAU-3512R	42165339320000	PROD_OIL	ACTIVE
SSAU-1402R	42165339340000	INJ_WAG	ACTIVE
SSAU-2903R	42165339350000	PROD_OIL	ACTIVE
SSAU-4005R	42165339360000	INJ_WAG	ACTIVE
SSAU-4203R	42165339380000	INJ_WAG	ACTIVE
SSAU-1311	42165340630000	PROD_OIL	ACTIVE
SSAU-1105	42165340860000	PROD_OIL	TA
SSAU-7607	42165341760000	PROD_OIL	P & A
SSAU-1205	42165341930000	PROD_OIL	ACTIVE
SSAU-1312	42165341940000	PROD_OIL	ACTIVE
SSAU-1517	42165342290000	PROD_OIL	ACTIVE
SSAU-1104	42165342300000	PROD_OIL	ACTIVE
SSAU-901IR	42165342320000	INJ_WAG	ACTIVE
SSAU-3803R	42165346470000	INJ_WAG	ACTIVE
SSAU-0903R	42165346480000	INJ_WAG	ACTIVE
SSAU-2229	42165346490000	PROD_OIL	ACTIVE
SSAU-1518	42165346500000	PROD_OIL	ACTIVE
SSAU-2922	42165348760000	PROD_OIL	ACTIVE
SSAU-5505R	42165349450000	PROD_OIL	ACTIVE
SSAU-5515R	42165350450000	PROD_OIL	INACTIVE
SSAU-1102R	42165352730000	INJ_WAG	ACTIVE
SSAU-4207R	42165360360000	PROD_OIL	ACTIVE
SSAU-3506R	42165361810000	PROD_OIL	ACTIVE
SSAU-3105B	42165361820000	PROD_OIL	ACTIVE
SSAU-4201R	42165362070000	INJ_WAG	ACTIVE

SSAU-5512R	42165364470000	PROD_OIL	ACTIVE
SSAU-3903R	42165364550000	PROD_OIL	ACTIVE
SSAU-2923	42165368650000	PROD_OIL	ACTIVE
SSAU-3123	42165369140000	PROD_OIL	P & A
SSAU-4314R	42165369390000	PROD_OIL	ACTIVE
SSAU-3123R	42165369440000	PROD_OIL	ACTIVE
SSAU-5503R	42165369580000	PROD_OIL	ACTIVE
SSAU-3515R	42165369810000	PROD_OIL	ACTIVE
SSAU-4125R	42165369820000	INJ_WAG	ACTIVE
SSAU-3910R	42165374780000	INJ_WAG	ACTIVE
SSAU-3528R	42165374790000	INJ_WAG	ACTIVE
SSAU-3534	42165374800000	PROD_OIL	ACTIVE
SSAU-4322R	42165375550000	PROD_OIL	ACTIVE
SSAU-4209	42165377730000	PROD_OIL	ACTIVE
SSAU-3104R	42165377800000	INJ_WAG	ACTIVE
SSAU-3520R	42165377850000	PROD_OIL	ACTIVE
SSAU-4118R	42165378080000	PROD_OIL	ACTIVE
SSAU-6222	42165379860000	INJ_H2O	ACTIVE
SSAU-6219	42165379970000	PROD_OIL	ACTIVE
SSAU-6217	42165380060000	PROD_OIL	ACTIVE
SSAU-6225	42165380140000	PROD_OIL	TA
SSAU-6220	42165380180000	PROD_OIL	ACTIVE
SSAU-6221	42165380230000	PROD_OIL	ACTIVE
SSAU-6223	42165380280000	PROD_OIL	TA
SSAU-6224	42165380310000	PROD_OIL	ACTIVE
SSAU-1910	42165380730000	PROD_OIL	ACTIVE
SSAU-2921R	42165382020000	PROD_OIL	ACTIVE
SSAU-1505R	42165386280000	INJ_WAG	ACTIVE
SSAU-2317R	42165386290000	PROD_OIL	ACTIVE
SSAU-4113R	42165386310000	PROD_OIL	ACTIVE
SSAU-2505R	42165386320000	PROD_OIL	ACTIVE
SSAU-3301R	42165386710000	INJ_WAG	ACTIVE
SSAU-3107R	42165386730000	INJ_WAG	ACTIVE
SSAU-3703R	42165386740000	PROD_OIL	ACTIVE
SSAU-4021S	42165386760000	PROD_OIL	ACTIVE

12.2 Regulatory References

Regulations cited in this plan:

1. 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

2. Oil and Gas Procedure Manual:
https://www.rrc.texas.gov/oil-and-gas/publications-and-notices/manuals/oil-and-gas-procedure-manual/

Request for Additional Information: Seminole San Andres Unit
February 6, 2023

Instructions: Please enter responses into this table and make corresponding revisions to the MRV Plan as necessary. Any long responses, references, or supplemental information may be attached to the end of the table as an appendix. This table may be uploaded to the Electronic Greenhouse Gas Reporting Tool (e-GGRT) in addition to any MRV Plan resubmissions.

No.	MRV Plan		EPA Questions	Responses
	Section	Page		
	NA	NA	Please ensure that the MRV plan defines all acronyms in the MRV plan. For example, CO_2-EOR is not defined.	Acronyms have been checked to ensure that they are defined in the first instance.
	3	4	"…174 million metric tons of CO2 to be stored over the remaining lifetime of the project." Please clarify whether 2055 is the projected end of the project.	Clarified text to indicate that 2055 is projected to be the end of the project.
	3.2 (Figure 3)	7	The thickness of the San Andreas Formation is included in the Figure but not for the other formations mentioned in the text. Please address.	Removed the thickness of San Andres from the graphic.
	3.2	7	"There are numerous relatively thin layers that provide additional secondary containment between the sequestration zone and freshwater aquifers found at **250 feet**." Please clarify whether 250 feet refers to the depth of the aquifers or another distance.	Clarified to indicate depth of 250 feet.
	3.2	8	"Over time, buoyant fluids, including CO_2, rose vertically until reaching the ceiling of the dome and then migrated to the highest elevation of the structure." Please clarify whether the ceiling of the dome is the highest elevation of the structure.	Clarified sentence: "Over time, buoyant fluids, including CO_2, rose vertically until reaching the highest elevation of the structure."

No.	MRV Plan		EPA Questions	Responses
	Section	Page		
	3.3	11	"…separated for sale metered through a custody transfer **meter it is** moved into the…" It appears the above sentence is missing a word. Please revise.	Revised sentence for clarity: "…oil is separated for sale and metered through a custody transfer meter, and then moved into the pipeline;…"
	4	15	Per 40 CFR 98.449, active monitoring area is defined as the area that will be monitored over a specific time interval from the first year of the period (n) to the last year in the period (t). The boundary of the active monitoring area is established by superimposing two areas: (1) The area projected to contain the free phase CO2 plume at the end of year t, plus an all around buffer zone of one-half mile or greater if known leakage pathways extend laterally more than one-half mile. (2) The area projected to contain the free phase CO2 plume at the end of year t + 5. Per 40 CFR 98.449, maximum monitoring area is defined as equal to or greater than the area expected to contain the free phase CO2 plume until the CO2 plume has stabilized plus an all-around buffer zone of at least one-half mile. While the plan identifies the AMA and MMA, please provide a rationale for these delineations, explaining whether the AMA and MMA meet the definitions in 40 CFR 98.449. In addition, we recommend adding a figure that clearly shows the boundaries of the AMA and MMA with figure also showing the modeled or expected extent of the CO_2 plume(s) in the subsurface.	Added text that describes CO_2 is present and remains contained in the SSAU and added a map that shows the AMA and MMA.

No.	MRV Plan		EPA Questions	Responses
	Section	Page		
8	5.2	18	"After reviewing geologic, seismic, **and operating data, and other evidence,** Oxy concluded that there are no known faults or fractures…" Please consider revising the above sentence for clarity.	Modified sentence: "After reviewing geologic and seismic data, Oxy concluded that there are no known faults or significant fractures that transect the San Andres Formation in the project area." Also clarified the first sentence of the following paragraph to indicate that Oxy manages the unit to avoid inducing faults or fractures.
9	5.3	18	"In December 2022, Oxy reviewed the USGS database of recorded earthquakes at M3.0 or greater in the Permian Basin indicates that none have occurred at or near the Seminole Field; the nearest seismic event occurred in 1992 approximately 30 miles away." Please consider revising the above sentence for clarity.	Modified sentence for clarity: "In December 2022, Oxy reviewed the United States Geological Survey (USGS) database of recorded earthquakes at M3.0 or greater in the Permian Basin and found that none have occurred at or near the SSAU. The nearest recorded earthquake occurred in 1992 and was located approximately 30 miles away."
[illegible]	5.3	18	"One concern about induced seismicity is that it could lead to fractures in the seal providing a pathway for CO2 Surface Leakage. As explained above, 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 SSAU" The above section mentions induced seismicity as a concern but then discusses risk associated with natural seismicity. Please elaborate on the risk of induced seismicity. E.g., will the facility take steps to ensure seismicity is not induced?	Revised text to clarify that operation procedures are designed to limit risk of induced faults or fractures: "The absence of any M3.0 or greater seismic events at or near SSAU indicates that Oxy's injection operations at SSAU do not induce seismicity. Also, natural seismicity is not significant in the area. Therefore, Oxy concludes there is no likely seismicity pathway for CO_2 Surface Leakage."

No.	MRV Plan		EPA Questions	Responses
	Section	Page		
	5.9	21	"As discussed above, the potential sources of CO_2 Surface Leakage include surface equipment (pumps, valves, etc.) or subsurface equipment (wellbores)." Although these pathways might present the most likely sources of surface leakage, 40 CFR 98.448(a)(3) requires reporters to present a strategy for detecting and quantifying any surface leak of CO_2. Therefore, please ensure that the MRV plan addresses detection and quantification strategies for all identified leakage pathways, even if they are believed to present minimal risk of surface leakage.	Revised text: "Oxy monitors the potential sources of CO_2 Surface Leakage." Added text: "Surface monitoring will allow for detection and quantification of all potential leakage pathways."
	6.1.5	25	"Anomalies in injection zone pressure may not indicate that CO_2 Surface Leakage." The above sentence is an incomplete sentence. Please revise.	Revised text (now located in 6.2.2): "Anomalies in injection zone pressure may not indicate CO_2 Surface Leakage."
	6.1.5	26	"… by field personnel will be used as a supplement **for to** identify CO_2 Surface Leakage that may escape visual detection." The above sentence has an extra word. Please revise.	Revised text (now located in 6.2.3): "… by field personnel will be used as a supplement to identify CO_2 Surface Leakage that may escape visual detection."

No.	MRV Plan		EPA Questions	Responses
	Section	Page		
	8	28-32	"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, Oxy proposed and will 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 avoids propagating significant errors that would occur if data were taken from the individual wellhead meters within the SSAU." You must calculate geologic sequestration, CO_2 injected, CO_2 recycled, and CO_2 produced according to the methods/equations prescribed in the regulations at 40 CFR 98.443. Please explain whether each of the proposed calculation methodologies follow the subpart RR regulations, and/or revise this section of the MRV plan as necessary. Please also ensure that the locations/flowmeters you identify for use in the calculations are consistent with the requirements at 40 CFR 98.443 and 98.444.	We believe we have addressed the request to use the methods and equations in 40 CFR 98.443 by stating the following in the text: "This section describes how Oxy uses the equations in Subpart RR §98.443 to calculate the mass of CO_2 received using equations RR-2 and RR-3, the mass of CO_2 injected using equations RR-5 and RR-6, the amount of CO_2 produced using equations RR-8 and RR-9, the mass of CO_2 Surface Leakage using equation RR-10, and the mass of CO_2 sequestered using equation RR-11."

No.	MRV Plan		EPA Questions	Responses
	Section	Page		
	8.3	30	"Xoil = Mass of entrained CO_2 in oil in the reporting year measured utilizing commercial meters and electronic flow-measurement devices at each point of custody transfer. The mass of CO_2 will be calculated by multiplying the total volumetric rate by the CO_2 concentration." Equation RR-9 in 98.443(d)(3) applies X as a factor which is the entrained CO_2 in produced oil or other fluid divided by the CO_2 separated through all separators in the reporting year (weight percent CO_2, expressed as a decimal fraction). Total CO_2 produced is (1+X)*mass of CO_2 produced through all separators. You must use the equations prescribed in the regulations at 40 CFR 98.443. Please revise this section to ensure that you do not modify equation RR-9. Furthermore, please provide detail on how the concentration of CO_2 in produced fluids will be determined.	In RR-9, changed text for X to the following: "Entrained CO_2 in produced oil or other fluid divided by the CO_2 separated through all separators in the reporting year (weight percent CO_2, expressed as a decimal fraction)."
	8.4	31	"Equation RR-10 in 48.433 will be used to calculate and report the Annual Mass of CO_2 emitted by Surface Leakage:" The correct rule citation is 48.443. Please address.	Updated text to reference 98.443
	8.5	32	"CO_{2P} = Total annual CO_2 mass produced (metric tons) net of CO_2 entrained (i.e. dissolved) in oil in the reporting year." In equation RR-11, this variable is "CO_{2P} = Total annual CO2 mass produced (metric tons) in the reporting year." Equations and variables cannot be modified from the regulations. Please revise this section and ensure that all equations are consistent with those prescribed at 40 CFR 98.443.	In RR-11, updated text to show "CO_{2P} = Total annual CO2 mass produced (metric tons) net of CO2 entrained (i.e., dissolved) in oil in the reporting year;"
	8.5	32	Please clarify the date on which the collection of data for calculating total amount sequestered will begin, as required by 40 CFR 98.448(a)(7).	Updated date to reflect start of reporting from January 1, 2023

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

December 2022

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1. Introduction

OXY USA INC, a subsidiary of Occidental (Oxy) operates a CO_2-EOR project in the Seminole San Andres Unit (SSAU). 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 CO_2 sequestered at the SSAU during a specified period of injection.

2. Facility Information

2.1 Reporter Number

XXXX/TBD? –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 in-service wells in the SSAU (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 SSAU are currently classified as UIC Class II wells.

2.3 Existing Wells

Wells in the SSAU are identified by name and number, API number, type, and status. The list of wells as of November 2022 is included in Section 12.1. Any changes in these wells or additional wells will be indicated in the annual monitoring report.

3. Project Description

This project takes place in the SSAU, an oilfield located in West Texas that was first produced in 1941. CO_2 flooding was initiated in 1983 and the injection plan calls for an additional total of approximately 174 million metric tons of CO_2 to be stored over the remaining lifetime of the project. The field is well characterized and Oxy determined that it 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 1.0 or very close to it. Oxy constructed a history-matched reservoir simulation of the injection at SSAU.

3.1 Project Characteristics

The Seminole San Andres field was discovered in 1936 and started producing in 1941. The field was unitized in 1968, and waterflood was initiated in 1969. CO_2 flooding was initiated in 1983. A long-term forecast for SSAU was developed using the reservoir modeling approaches described in Section 3.4, including storage of an additional total of approximately 174 million metric tons of CO_2 over the remaining life of the project. Figure 1 shown below, is a graph of the quantity of CO_2 injected, produced and stored between 1983 and 2021 (solid lines) and a forecast of the CO_2 that will be injected, produced and stored between 2022 and 2055 (dashed lines) in the SSAU. Oxy has injected 224 MMT of CO_2 into the SSAU through the end of 2021. Of that amount, 109 MMT CO_2 was produced and 115 MMT CO_2 was stored. Oxy forecasts CO_2 injection of 532 MMT from the year 2022 until the year 2055. Of that amount, 358 MMT is forecast to be produced and 174 MMT will be stored.

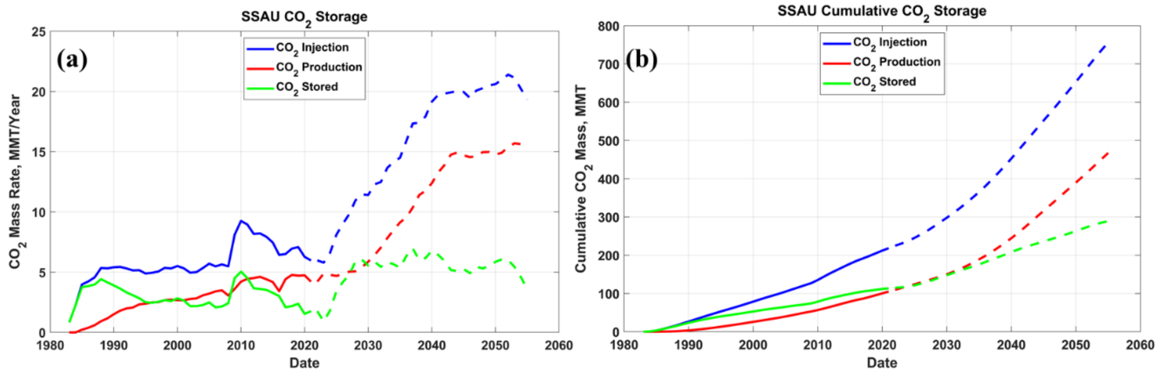

Figure 1—SSAU Historic and Forecast CO_2 Injection, Production, and Storage (a) Rate (MMT/Year), (b) Cumulative Mass (MMT)

3.2 Environmental Setting

The SSAU is located in the northeast portion of the Central Basin Platform in West Texas (Figure 2).

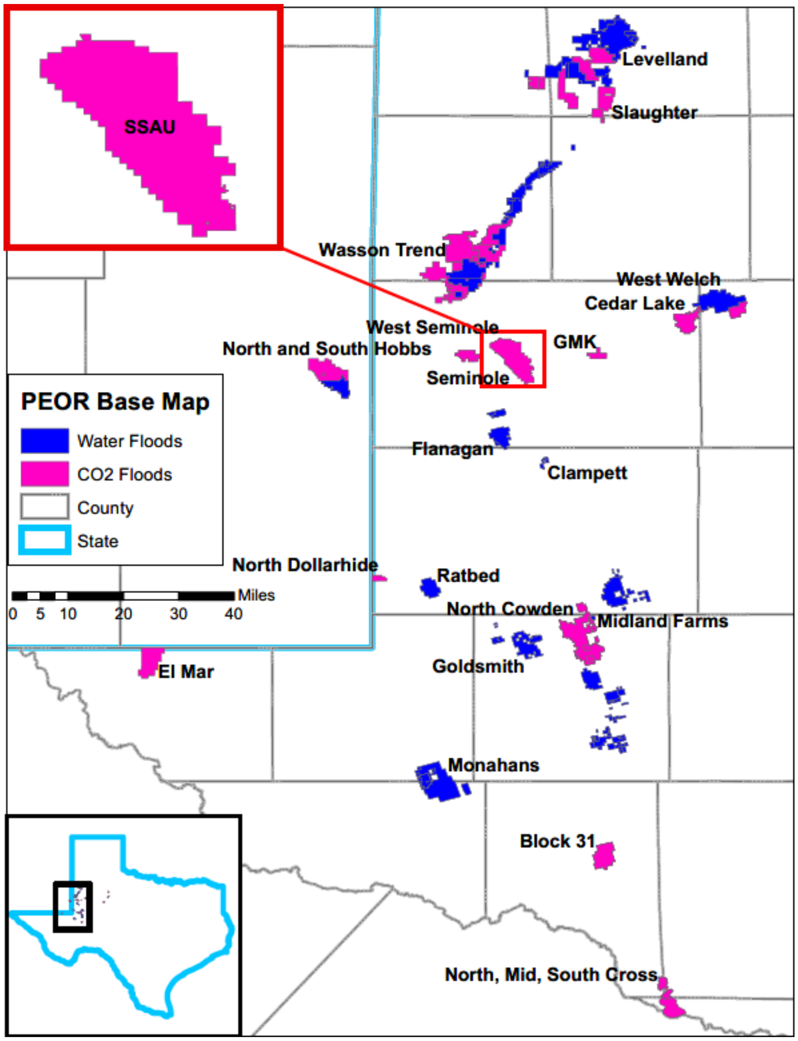

Figure 2—Location of SSAU in West Texas

Figure 3 is a schematic of the SSAU storage complex. The SSAU sequestration zone ranges between 1,165 and 1,850 ft in thickness with an average thickness of 1,600 ft. This productive interval, or reservoir, is within the San Andres Formation and 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.

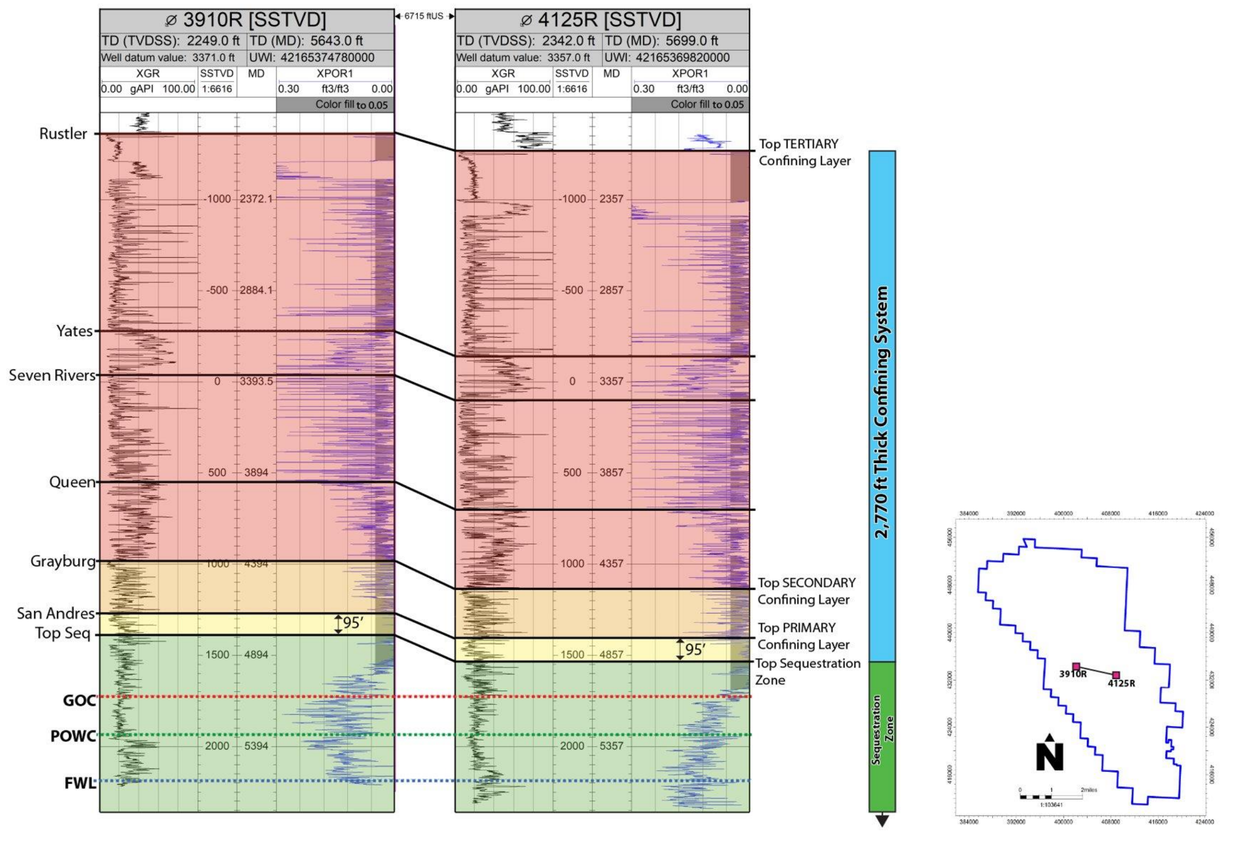

Figure 3—SSAU Geologic Column

Figure 3 shows the overlying confining system, which consists of non-porous anhydritic strata that are ~2,770 ft thick and are comprised of three sub-zones:

- A ~95 ft thick primary confining layer between the top of sequestration zone and top of San Andres Formation;
- A ~200 ft thick secondary confining layer between San Andres Formation and Grayburg Formation; and,
- A ~2,350 ft thick tertiary confining layer from the Grayburg Formation to the Rustler Formation.

There are numerous relatively thin layers that provide additional secondary containment between the sequestration zone and freshwater aquifers found at 250 feet. These layers are comprised of siltstones, shales, salts, and anhydrite sequences with little to no porosity or permeability.

SSAU is located in the Permian Basin on the northeast portion of the Central Basin Platform in West Texas. SSAU is draped over a fault-bounded doubly plunging anticline that tips out in Devonian strata where several N-NW trending seismically resolvable faults have been identified and mapped. Faults are situated southwest of the structural crest, with a maximum offset of 1,800 ft within Devonian strata and tip out approximately 1,700 ft below the SSAU sequestration zone. Oxy extensively analyzed seismic data acquired over the SSAU to assess potential leakage pathways and basement-rooted faults. Oxy determined that seismic attributes, such as coherence, do not reveal linear discontinuities beyond those currently mapped. Likewise, Oxy found that downhole measurements from profile logs and micro-resistivity imaging tools show no indication of conductive faults or fractures. Pressure-based interference tests and simulation-based history matching also indicate that reservoir behavior has not been modified by faults and fractures. In summary, Oxy determined that multiple fault/fracture characterization tools indicate the sequestration zone and confining system are free of faults and fractures that could act as leakage pathways.

SSAU is a dome structure that includes the highest elevations within the area. The elevated area forms a natural trap for oil and gas that migrated upward from deeper source rocks over millions of years. Once trapped in these higher elevations, the oil and gas remained in place. In the case of SSAU, this oil and gas has been trapped in the reservoir for 50 to 100 million years. Over time, buoyant fluids, including CO_2, rose vertically until reaching the ceiling of the dome and then migrated to the highest elevation of the structure. Figure 4 shows the Top San Andres pay interval structure. The colors in the structure map in Figure 4 indicate the subsurface elevation, with red illustrating a higher or shallower level and dark blue illustrating a lower or deeper level.

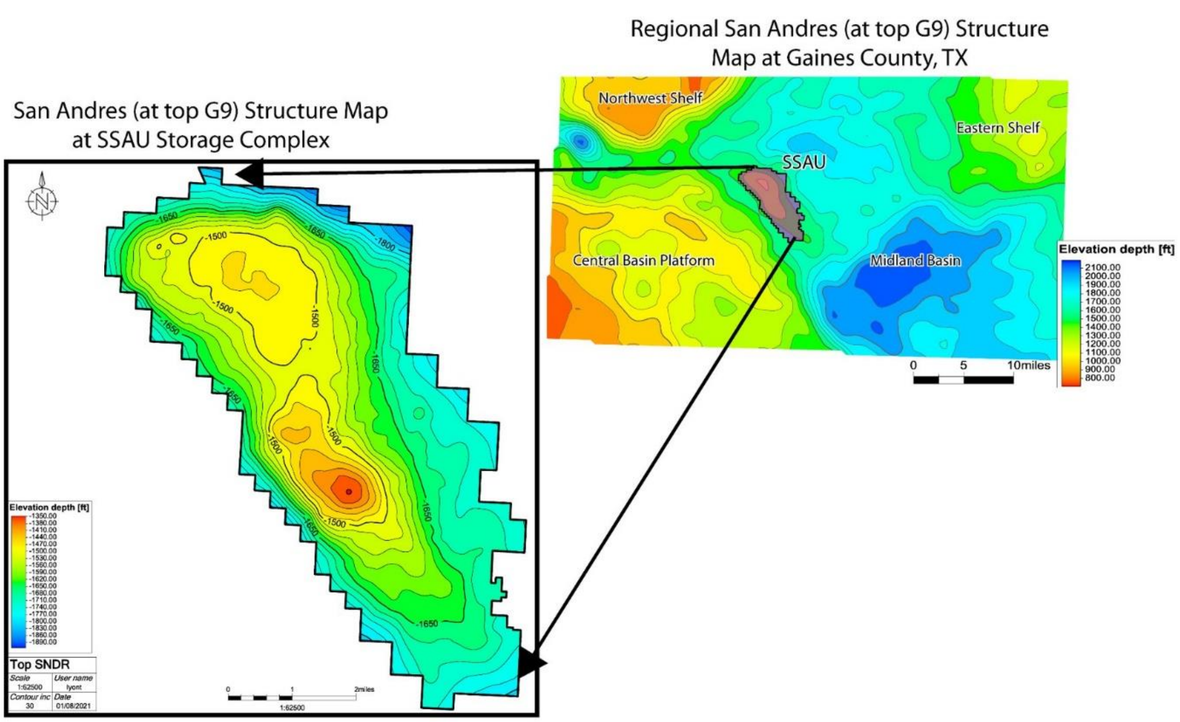

Figure 4—Local Area Structure on Top of San Andres

Because of buoyancy differences between oil, water and gas phases, the gas column at SSAU sits above the oil. Water, being the least buoyant of the three fluid phases, is found below the oil. At the time of its discovery, natural gas was trapped at the structural high points of SSAU, 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 Formation. Gas is buoyant and highly mobile. If it could escape

SSAU naturally, through faults or fractures, it would have done so over the millennia. Below the gas cap is an oil accumulation called the oil zone. There are no distillable hydrocarbons below the oil zone.

Once the CO_2 flood is complete and injection ceases, the remaining mobile CO_2 will rise slowly upward, driven by buoyancy forces and will be trapped by the confining system. There is more than enough pore space to sequester the planned CO_2 injection. The amount of CO_2 injected will not exceed the reservoir's secure storage capacity; consequently, there is negligible risk that CO_2 could migrate to other reservoirs in the Central Basin Platform. The total reservoir pore volume is calculated to be 5,816 million reservoir barrels (RB) from the top of the reservoir down to the base of the oil zone. This equals the volume of rock multiplied by porosity. Table 1 shows the conversion of this amount of pore space into an estimated maximum mass of CO_2 storage of approximately 509 MMT. The total stored CO_2 from previous EOR and the planned forecast injection will fill approximately 57% of the total calculated storage capacity.

Table 1—Calculation of Maximum CO_2 Storage Capacity (MMT) at SSAU

Top of Pay to Free Water Level (2,175 ft subsea)	
Variables	SSAU Outline
Pore Volume (MMRB)	5,816
B_{CO_2}	0.41
S_{wirr}	0.18
S_{orCO_2} (volume weighted)	0.14
Max CO_2 (Bcf)	9,646
Max CO_2 (MMT)	509

$$\text{Max } CO_2 = \text{Pore Volume (RB)} * (1 - S_{wirr} - S_{orCO_2}) / B_{CO_2}$$

Where:

Max CO_2 = maximum CO_2 storage capacity, MMT
Pore Volume (RB) = volume of the rock formation in Reservoir Barrels
B_{CO_2} = formation volume factor for CO_2
S_{wirr} = irreducible water saturation
S_{orCO_2} = irreducible oil saturation

Oxy has a high degree of confidence that stored CO_2 will be contained securely within the reservoir because: 1) SSAU is located at the highest subsurface elevations in the area; 2) the confining zone has proved competent over millions of years and with current CO_2 flooding; and, 3) SSAU has ample storage capacity.

3.3 Description of CO_2-EOR Project Facilities and the Injection Process

Figure 5 shows a simplified process flow diagram (PFD) of the project facilities and equipment in the SSAU. CO_2 is delivered to SSAU via the Permian Basin CO_2 pipeline network from a number of different sources.

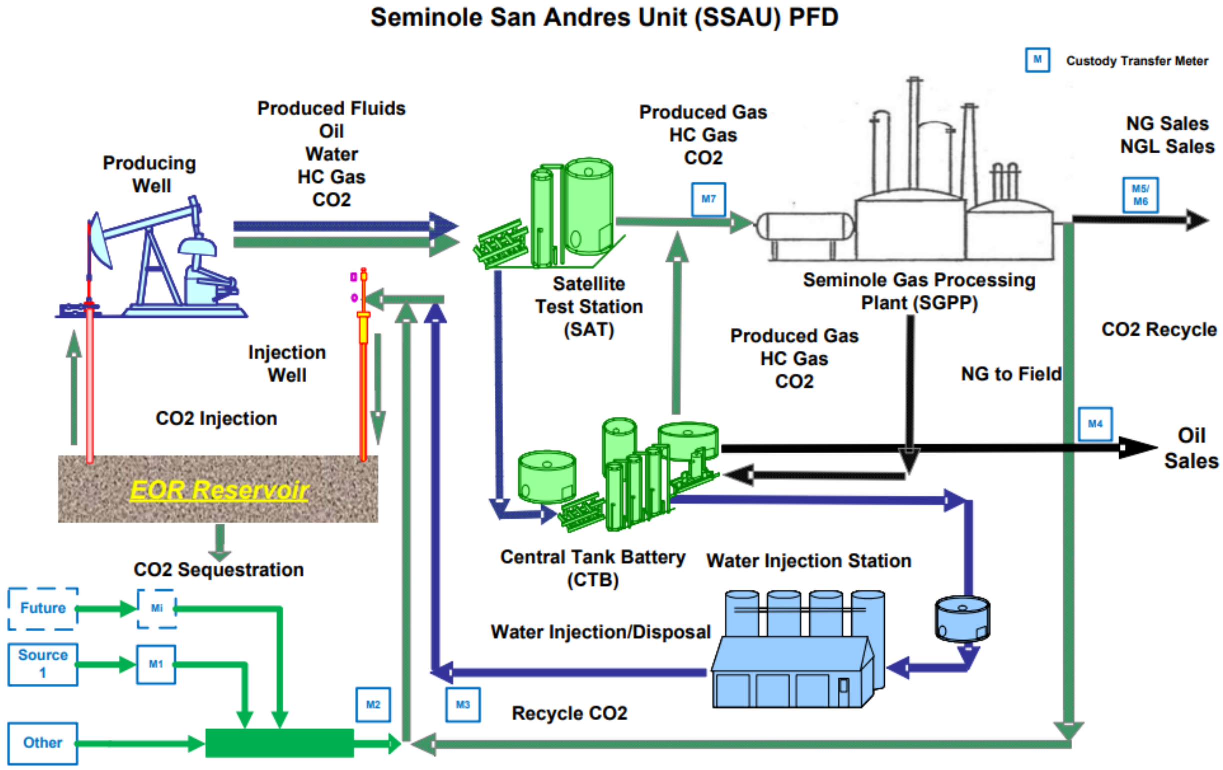

Figure 5—SSAU Process Flow Diagram

Once CO_2 enters SSAU, there are three main processes involved in EOR operations:

1. **CO_2 Distribution and Injection.** The mass of CO_2 received at SSAU is metered and calculated through the Custody Transfer Meter located at the pipeline delivery point, as indicated by the box labeled "M2" in the bottom left of Figure 5. The mass of CO_2 received is combined with recycled CO_2 from the Seminole Gas Processing Plant (SGPP), denoted by box labeled "M3", and distributed to the CO_2 trunklines for injection into the injection wells according to the pre-programmed injection plan for each well pattern, which alternates between water and CO_2 injection. This is an EOR project, and reservoir pressure must be maintained above the minimum miscibility pressure (MMP). Therefore, injection pressure is maintained at a level that is sufficiently high to allow injectants to enter the reservoir, but below the formation parting pressure (FPP).

2. **Produced Fluids Handling.** Produced fluids from the production wells are a mixture of oil, hydrocarbon gas, water, CO_2 and trace amounts of other constituents in the field including nitrogen and hydrogen. Fluids are gathered from producer wells and sent to satellite test stations (SAT) for separation into a gas/CO_2 mix and a produced fluids mix of water, oil, gas, and CO_2. The gas/CO_2 mix, which is composed primarily of hydrocarbons and CO_2, is sent to the SGPP for CO_2 separation, dehydration, sweetening, and compression before reinjection into the reservoir. The mix of water, oil, gas, and CO_2 is sent to the central tank battery (CTB) where water is separated for reinjection or disposal;

oil is separated for sale metered through a custody transfer meter it is moved into the pipeline; and, the remaining gas/CO_2 mix is combined with gas/CO_2 separated from the produced fluids in the SAT. The total amount of CO_2 produced is measured using meters labeled "M7" and "M3" on Figure 5.

3. **Water Treatment and Injection.** Water is recovered from the CTB for reuse and forwarded to the water injection station for treatment and reinjection using a closed loop process or for disposal.

3.3.1 Wells in the SSAU

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 Oil and Gas Procedure Manual (see Appendix 12.2). 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 underground sources of drinking water 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 where they are encountered into other strata, or into subsurface and surface waters;
- A completion report for each well that includes an electric log (e.g., a density, sonic, or resistivity) 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 and the location and setting of plugs; and,
- Injection well operators must identify an Area of Review (AoR), use materials and equipment compatible with the injection fluids, test, and maintain well records.

Table 2 provides a well count by type and status as of November 2022. All these wells are in material compliance with TRRC rules.

Table 2—SSAU Well Penetrations by Type and Status (as November 2022)

Row Labels	ACTIVE	INACTIVE	P & A*	SHUT-IN	TA**	Grand Total
INJ_H2O	27	4	16	0	10	57
INJ_WAG	190	3	11	4	2	210
PROD_OIL	306	21	60	0	30	417
Grand Total	**523**	**28**	**87**	**4**	**42**	**684**

**P&A = Plugged and Abandoned*
***TA = Temporarily Abandoned*

As indicated in Figure 6, wells are distributed across the SSAU. The well patterns currently undergoing CO_2 flooding are outlined in the black box. During the life of the project the well count and status is projected to change as the SSAU injection plan is implemented. Oxy may seek TRRC approval to drill new wells, recomplete existing wells, or plug and abandon existing wells. Such changes will be included in the annual monitoring report.

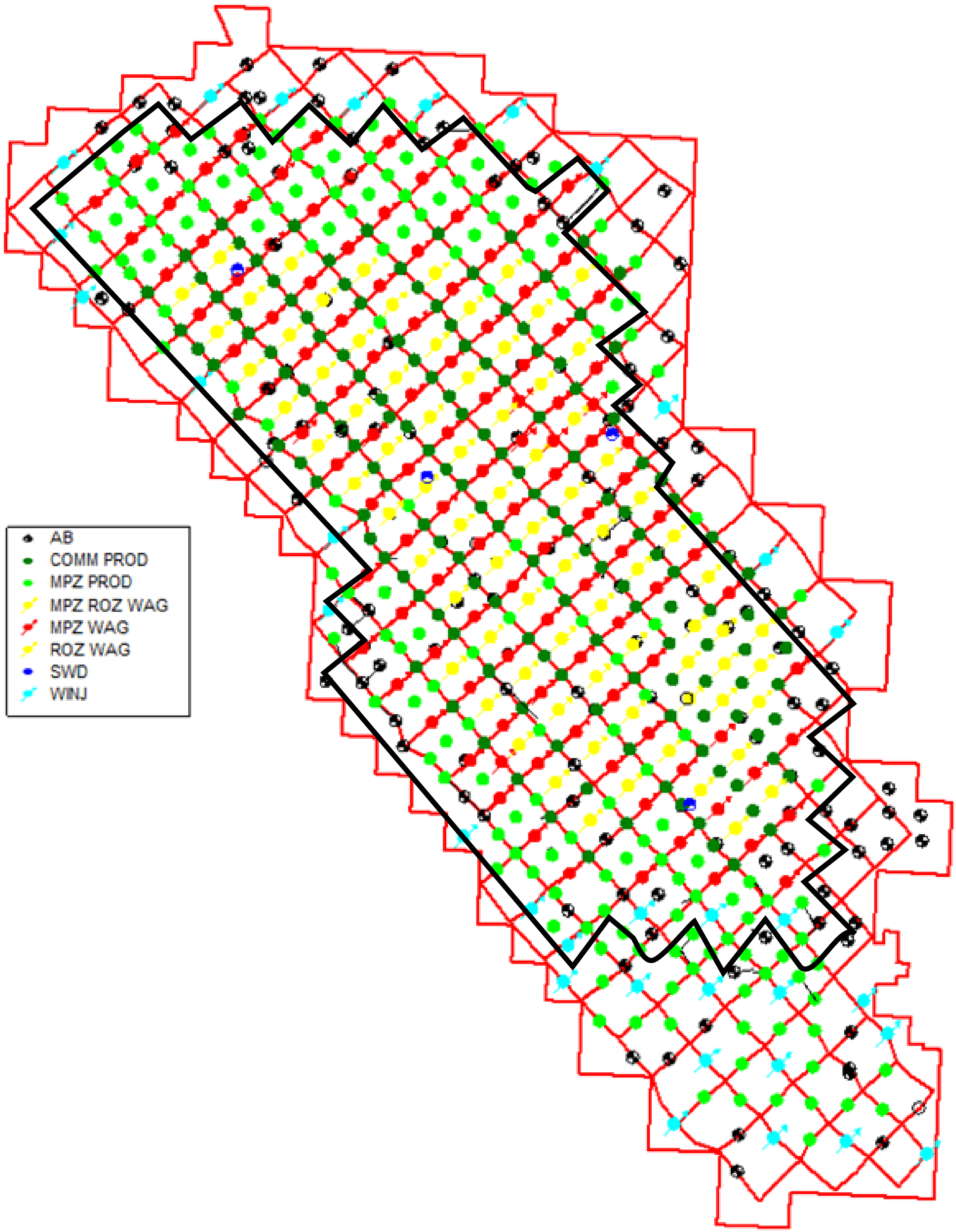

Figure 6—SSAU Wells and Injection Patterns

SSAU CO_2 EOR operations are designed to avoid conditions that could damage the reservoir and create a potential leakage pathway. Oxy manages reservoir pressure by maintaining an injection-to-withdrawal ratio (IWR)[1] of approximately 1.0. To do this, 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 oilfield.

Oxy maintains injection pressure below the FPP, which is measured using step-rate tests.

3.4 Reservoir Modeling

A history-matched reservoir model of the current and forecast SSAU CO_2 injection plan has been constructed using tNavigator, which is a commercially available reservoir simulation software program. The model simulates the recovery mechanism in which CO_2 is miscible with the hydrocarbon phase in the reservoir.

The model was created to:

- Demonstrate that the storage complex has, at the minimum, the capacity to contain the planned mass of injected CO_2; and
- Track injected CO_2, identify how and where CO_2 is trapped in the SSAU, and monitor sequestration mass and distribution.

The reservoir model utilizes four types of data:

1. Site Characteristics as described in the SSAU geomodel,
2. Initial reservoir conditions and fluid property data,
3. Capillary pressure data, and
4. Well data.

The static geomodel that serves as the foundation for the dynamic simulation model used data from digital open- and cased-hole logs of 684 wells within the SSAU boundary to correlate formation tops. Oxy developed a sequence stratigraphic framework for SSAU based on core descriptions and outcrop analogs. Oxy selected the sequence stratigraphic correlations of flow units at the base of mud-dominated flooding surfaces in core, linked to well logs, and extrapolated throughout the field.

The dynamic simulation model is a four-component model consisting of water, oil, reservoir gas, and injected CO_2. It is an extension of the black oil model that enables the modeling of various recovery mechanisms, including miscible injection of CO_2, that is justified because the reservoir under study is above MMP. Oxy used the total hydrocarbon and solvent (CO_2) saturation to calculate relative permeability to water. Oxy then used the solvent and oil relative permeability to

[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.

calculate multipliers from a look-up table. Oxy used the Todd-Longstaff[2] model to calculate the effective viscosity and density of the hydrocarbon and solvent phases.

Oxy conducted history matching on the dynamic simulation model to adjust input parameters within the range of data uncertainties until the actual reservoir performance was closely reproduced in the model. Using this process, Oxy obtained an 84-year history match. 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 four graphs in Figure 7 present the history match results of oil rate, water rate, liquid rate, and gas rate, showing that the reservoir model provides an excellent match to actual historical data. Figure 8 shows the matches of water and CO_2 injection.

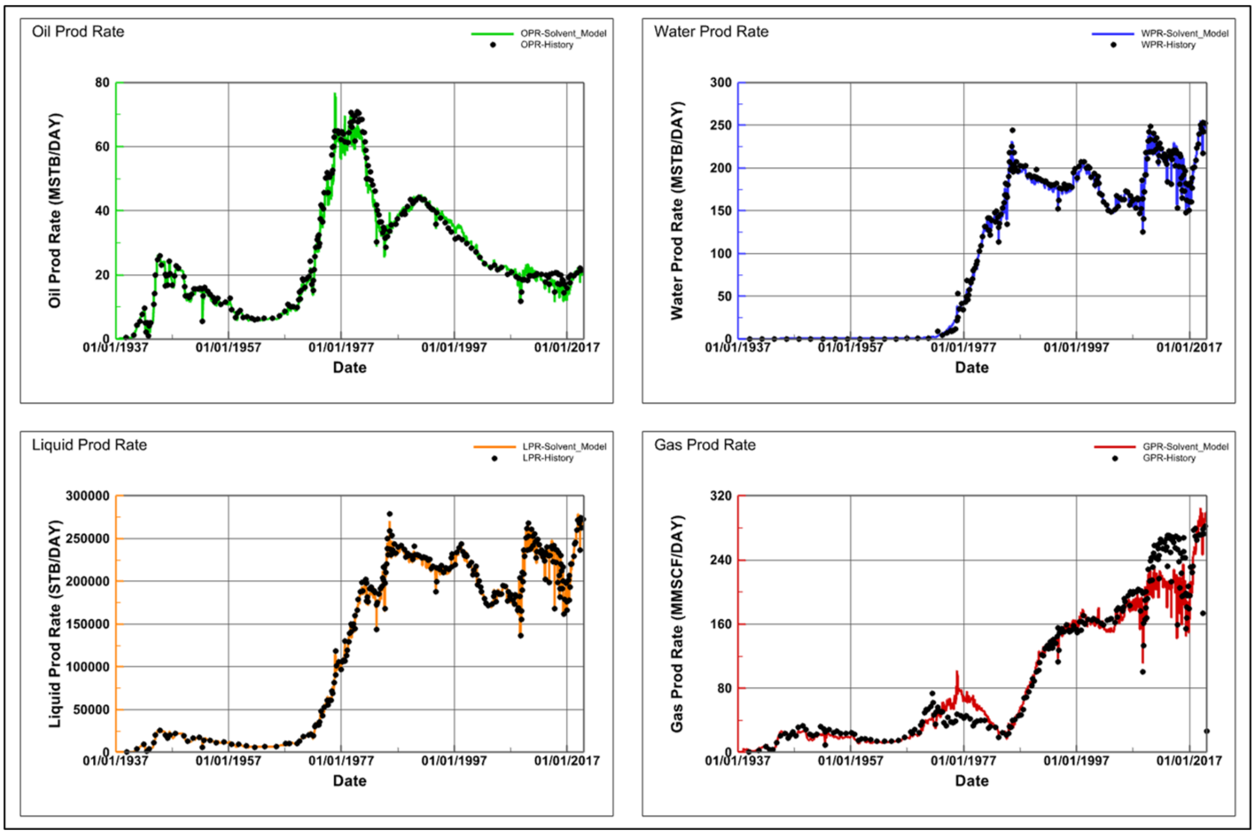

Figure 7—Four Parameters of History-Matched Modeling in the SSAU Reservoir Model

[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).

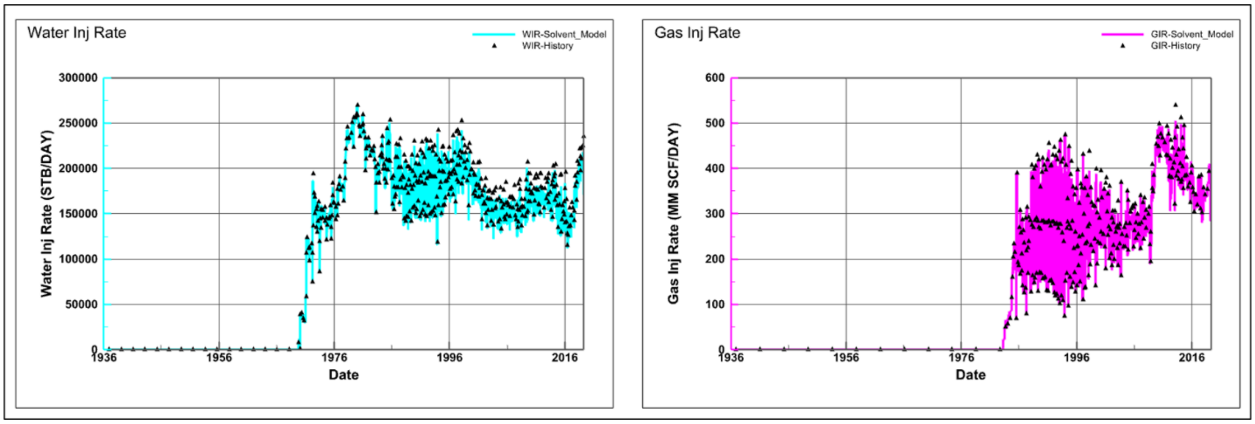

Figure 8—Plots of Injection History Match in the SSAU Reservoir Model

Oxy used the SSAU reservoir model to evaluate the plume of CO_2 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's CO_2 storage performance. The model forecast showed that CO_2 is contained in the reservoir within the boundaries of SSAU.

4. Delineation of Monitoring Area and Timeframes

4.1 Active Monitoring Area

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

4.2 Maximum Monitoring Area

The Maximum Monitoring Area (MMA) is defined by the boundary of the SSAU plus the required ½-mile buffer.

4.3 Monitoring Timeframes

The primary purpose for injecting CO_2 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 CO_2 in the SSAU. The specified period will be shorter than the period of production from the SSAU.

At the conclusion of the specified period, a request for discontinuation of reporting will be submitted with a demonstration that current monitoring and model(s) show that the cumulative mass of CO_2 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

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

this demonstration almost immediately after the specified period ends, based upon predictive modeling supported by monitoring data.

The reservoir pressure in the SSAU is collected for use in reservoir modeling and operations management. Reservoir pressure is not forecast to change appreciably because the IWR will be maintained at approximately 1.0. The reservoir model shows that by the end of CO_2 injection, average reservoir pressure will be approximately 2,790 psi. Once injection ceases, reservoir pressure is predicted to stabilize within one year. Over time, reservoir pressure is expected to decline 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.

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

In the 84 years since the SSAU oilfield 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 CO_2 to the surface, including:

1. Existing Wellbores,
2. Faults and Fractures,
3. Natural and Induced Seismic Activity,
4. Previous Operations,
5. Pipeline/Surface Equipment,
6. Lateral Migration Outside the SSAU,
7. Drilling Through the CO_2 Area, and
8. 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 CO_2 flooding, an extensive review of all SSAU penetrations was completed to determine the need for any corrective action. That analysis showed that all penetrations have either been adequately plugged and abandoned or, if still in use, do not require corrective action. All wells Oxy constructed and operates in the SSAU are in compliance with TRRC rules.

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

- CO_2 flood beam-pumped wells,
- Electrical submersible pump (ESP) producer wells,
- Naturally flowing producer wells,
- Hydraulic jet pump producer wells, and
- CO_2 WAG injector wells
- Water injectors.

A risk assessment undertaken for SSAU classified all risks associated with the 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 SSAU geology is well suited to CO_2 sequestration with an extensive confining zone that is free of fractures and faults that could be potential conduits for CO_2 migration. The low risk is supported by the results of the reservoir model, which shows that stored CO_2 is not predicted to leave the SSAU boundary. Any risks are further mitigated because the SSAU is operated in a manner that maintains, monitors, and documents the integrity of the reservoir.

The risk of well leakage is mitigated through:

- Adhering to regulatory requirements for well drilling and testing;
- Implementing best practices Oxy has developed through its extensive operating experience;
- Monitoring injection and production performance, wellbores, and the surface; and,
- Maintaining surface and subsurface equipment.

Continual and routine monitoring of the wellbores and site operations will be used to detect leaks or other potential well problems, as follows and as discussed in Section 6.1.5 below:

- Pressure in injection wells is monitored on a continual basis. The injection plans for each pattern are programmed into the injection WAG skids to govern the rate, pressure, and duration of either water or CO_2 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 an 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 CO_2 EOR projects, is that such leakage is very rare, and there have been no incidents of fluid migration out of the intended zone at SSAU.
- Production well performance is monitored using the production well tests, when produced fluids are gathered and sent to a 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 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 CO_2 flooding efficiency is optimized. Production well performance that does not meet planned performance is investigated and any identified issues are addressed. Leakage to the outside of production wells is not considered a major risk because reduced pressure in the casing will prevent leakage outside the wellbore. Further, the personal H_2S monitors are designed to detect the presence of leaked fluids around production wells during well inspections.

- Field inspections are conducted on a routine basis by field personnel. CO_2 leaking through an orifice is cold and leads to formation of bright white clouds and ice that are easily spotted. All field personnel are trained to identify leaking CO_2 and other potential problems at wellbores and in the field. Any CO_2 Surface Leakage detected will be documented and reported and quantified.

Based on ongoing monitoring activities and review of the potential leakage risks posed by wellbores, Oxy concludes that the risk of CO_2 Surface Leakage through wellbores is being mitigated by continuous monitoring and by promptly responding to any detected problems as they arise. Any mass of CO_2 Surface Leakage that occurs will be quantified.

5.2 Faults and Fractures

After reviewing geologic, seismic, and operating data, and other evidence, Oxy 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 Surface Leakage due to known fractures or faults.

Oxy manages injections patterns to ensure that the injection pressure does not exceed formation parting pressure (FPP). Oxy routinely measures and updates FPP and reservoir pressure. Oxy also maintains an IWR at or near 1.0. These practices mitigate the potential for CO_2 injection to induce faults or fractures. As a safeguard, WAG skids are continuously monitored and equipped with automatic shutoff controls should injection pressures exceed programmed settings.

5.3 Natural or Induced Seismicity

After reviewing the literature and actual operating experience, Oxy concluded that there is no direct evidence that natural seismic activity poses a significant risk for loss of CO_2 to the surface in the Permian Basin, specifically in the SSAU.

To evaluate the potential seismic risk at SSAU, Oxy 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 seismic events are judged to be from natural causes. Others are near oilfields or water disposal wells and are placed in the category of "quakes in close association with human enterprise."[4] In December 2022, Oxy reviewed the USGS database of recorded earthquakes at M3.0 or greater in the Permian Basin indicates that none have occurred at or near the Seminole Field; the nearest seismic event occurred in 1992 approximately 30 miles away. Oxy also participates in the TexNet seismic monitoring network[5] and will continue to monitor for seismic signals that could indicate the creation of potential leakage pathways in SSAU.

One concern about induced seismicity is that it could lead to fractures in the seal providing a pathway for CO_2 Surface Leakage. As explained above, there is no direct evidence to suggest that natural seismic activity poses a significant risk for loss of CO_2 to the surface in the Permian Basin, and specifically in SSAU. In addition, Oxy is not aware of any reported loss of injectant (brine water or CO_2) to the surface above SSAU associated with any seismic activity. If induced

[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

seismicity resulted in a pathway for material amounts of CO_2 to migrate from the injection zone, Oxy's other reservoir fluid monitoring provisions (e.g., reservoir pressure, well pressure, and pattern monitoring) would detect the migration and lead to further investigation.

5.4 Previous Operations

CO_2 flooding was initiated in SSAU in 1983. To obtain permits for CO_2 flooding, the AoR around all CO_2 injector wells was evaluated for the presence of any known and unknown penetrations and to assess if corrective actions were required. As indicated in Section 5.1, this evaluation reviewed the identified penetrations and determined that no additional corrective actions were 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. Throughout its CO_2 EOR operations, Oxy's constructs wells with materials that are designed to be compatible with CO_2 injection. These practices ensure that there are no unknown penetrations within SSAU and that the risk of a release from legacy wells has been evaluated (as already indicated, no corrective actions were required). Oxy's continuous monitoring program, described above in section 5.1, further mitigates the risk of a CO_2 Surface Leakage from the identified penetrations. The successful experience with CO_2 flooding in SSAU demonstrates that the confining zone has not been impaired by previous operations.

5.5 Pipelines and Surface Equipment

As part of routine risk management described in Section 5.1, the potential risk of Surface Leakage associated with the following were identified and evaluated:

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

As described in Section 5.1, the risk assessment classified all subsurface risks as low, 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 SSAU is operated in a manner that maintains, monitors, and documents the integrity of the reservoir.

The risk of pipeline and surface equipment leakage is mitigated through:

- Adhering to regulatory requirements for well drilling and testing;
- Implementing best practices Oxy has developed through its extensive operating experience;
- Monitoring injection and production performance, wellbores, and the surface; and,
- Maintaining subsurface and surface equipment.

Personnel continuously monitor the pipeline using the SCADA system and can 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 CO_2 EOR projects in the oil and gas industry. Operating and maintenance practices currently follow and will continue to follow demonstrated industry standards. CO_2 delivery via the Permian Basin CO_2 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 Surface Leakage be detected from pipeline or surface equipment, the mass of CO_2 Surface Leakage will be quantified following the requirements of Subpart W of EPA's GHGRP.

5.6 Lateral Migration Outside the SSAU

It is highly unlikely that injected CO_2 will migrate downdip and laterally outside the SSAU because of the nature of the geology and the approach Oxy uses for injection. The SSAU boundary contains a local structural high of the San Andres formation, as well as overlying and underlying formations. As injected CO_2 will rise vertically upward over long periods of time, the SSAU structure forms a trap configuration that funnels the injected CO_2 towards the crest of the structure, thereby preventing lateral migration beyond the unit boundary. In addition, the planned injection mass and active fluid management during injection operations will prevent CO_2 from migrating laterally out of the structure. Finally, the total mass of fluids contained in the SSAU will stay relatively constant. Based on site characterization and planned and projected operations, it is estimated that the total mass of stored CO_2 will be considerably less than the calculated storage capacity.

5.7 Drilling in the SSAU

The TRRC regulates well drilling activity in Texas. Pursuant to TRRC rules, well casing shall be securely anchored in the hole to control the well effectively at all times, all usable-quality water zones shall be isolated and sealed off effectively to 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 re-entered. Well drilling activity at SSAU is conducted in accordance with TRRC rules. Oxy's visual inspection process, including routine site visits, will identify any unapproved drilling activity in the SSAU.

In addition, Oxy intends to operate SSAU 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 CO_2. Consequently, the risks associated with third parties penetrating the SSAU 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 ensures 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 investigations as to the cause.

5.9 Leakage Detection, Verification, and Quantification

As discussed above, the potential sources of CO_2 Surface Leakage include surface equipment (pumps, valves, etc.) or subsurface equipment (wellbores). Oxy uses an event-driven process to assess, address, track, and (if applicable) quantify any potential CO_2 Surface Leakage. Table 3 summarizes the range of identified potential scenarios that could result in CO_2 Surface Leakage, the monitoring activities designed to detect such leakage, the standard response, and other applicable regulatory programs requiring similar reporting.

Given the uncertainty concerning the nature and characteristics of any CO_2 Surface Leakage, the most appropriate methods for quantifying the mass of CO_2 Surface Leakage will be determined on a case-by-case basis. 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.

Any mass of CO_2 Surface Leakage confirmed will be quantified using acceptable emission factors, such as those found in 40 CFR Part 98 Subpart W. Oxy will use engineering estimates of CO_2 Surface Leakage based on measurements in the subsurface, field experience, and other factors, such as the frequency of inspection. CO_2 Surface Leakage will be documented, evaluated, and addressed in a timely manner. Records of CO_2 Surface Leakage 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 3—Response Plan for CO_2 Emitted from Surface Leakage

Risk	Monitoring Plan	Response Plan
Tubing Leak	Monitor changes in tubing and annulus pressure; Mechanical Integrity Testing (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 bottomhole pressure control	Blowout during well operations	Expeditiously conduct well kill procedures
Unplanned wells drilled through San Andres	Routine field inspection to prevent unapproved drilling; compliance with TRRC permitting for planned wells	Ensure compliance with TRRC regulations
Loss of seal in abandoned wells	Reservoir pressure in WAG Skids; 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 Skids; high pressure found in new wells	Fluid management along lease lines
Leakage through induced fractures	Reservoir pressure in WAG Skids; high pressure found in new wells	Comply with rules for keeping injection pressures below parting pressure
Leakage due to seismic event	Reservoir pressure in WAG Skids; high pressure found in new wells	Shut in injectors near seismic event, assess reservoir and take corrective action as needed

5.10 Summary

The structure and stratigraphy of the San Andres reservoir in the SSAU is ideally suited for the injection and storage of CO_2. The stratigraphy within the CO_2 injection zones is porous, permeable, and thick, providing ample capacity for long-term CO_2 storage. The reservoir is overlain by several intervals of impermeable geologic zones that form effective seals for fluids in the reservoir. After assessing the potential risk of release from the subsurface and mitigating the risk of leakage from wellbores, it has been determined that the potential threat of CO_2 Surface Leakage is extremely low.

In summary, based on a careful assessment of the potential risk of release of CO_2 from the subsurface, it has been determined that there are no leakage pathways at the SSAU that are likely to result in CO_2 Surface Leakage. Further, given the detailed knowledge of the field and its operating protocols, it is concluded that in the unlikely event CO_2 leakage to the surface occurs, either through identified or unexpected leakage pathways, it would be detected quickly, quantified, and addressed promptly.

6. Monitoring and Considerations for Calculating Site-Specific Variables

Monitoring will be used to determine the quantities in the mass balance equations and to make the demonstration that the CO_2 plume will not migrate to the surface after CO_2 injection is discontinued.

6.1 Variables for the Mass Balance Equation

6.1.1 General Monitoring Procedures

Flow rate, pressure, and gas composition data are monitored and collected from the SSAU 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 SSAU 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 and calibrated 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 CO_2 Received

As indicated in Figure 5, the volumetric rate of received CO_2 is measured using a commercial custody transfer meter at the point at which custody of the CO_2 from the Permian Basin CO_2 pipeline delivery system is transferred to the SSAU (M2). This meter measures flow rate continually. The transfer is a commercial transaction that is documented. CO_2 composition is governed by contract, and the gas is routinely sampled and analyzed. Fluid composition will be determined at least 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 CO_2 is received at the SSAU in containers.

6.1.3 CO_2 Injected in the Subsurface

Injected CO_2 will be calculated using the flow meter rate at the operations meter at the outlet of the SGPP (M3) and the custody transfer meter at the CO_2 offtake point from the Permian Basin CO_2 pipeline delivery system (M2).

6.1.4 CO_2 Produced, Entrained in Products, and Recycled

The following measurements are used for the mass balance equations in Section 8:

- CO_2 produced in the gaseous phase is calculated using the volumetric flow meters at the inlet to the SGPP (M7) and the inlet produced gas stream composition to the SGPP. This measurement is taken after the bulk two phase separation at the field satellite batteries and central tank battery. The produced gas stream still contains a mixture of hydrocarbon gas and CO_2. The stream composition is measured using inlet gas analyzers at the SGPP and the resulting CO_2 composition combined with the produced gas volumetric flow measurement are combined to calculate the inlet CO_2 to the facility.
- CO_2 that is entrained (i.e., dissolved) in produced oil and natural gas, as indicated in Figure 5, is calculated using volumetric flow through the custody transfer meters (M4-M6). M7 already includes the amount of CO_2 entrained in natural gas (M5 and M6) but does not include the amount of CO_2 entrained in oil (M4). Therefore, total CO_2 produced is measured by adding M7 and M4.
- Recycled CO_2 is calculated using the volumetric flow meter at the outlet of the SGPP, which is an operations meter (M3).

6.1.5 CO_2 Emitted by Surface Leakage

Oxy uses 40 CFR Part 98 Subpart W to estimate the mass of CO_2 emitted from equipment leaks at the SSAU. Subpart W uses a factor-driven approach to estimate CO_2 emitted from equipment leaks. In addition, Oxy uses an event-driven process to assess, address, track, and (if applicable) quantify the mass of CO_2 Surface Leakage. The Subpart W report and results from any event-driven quantification will be reconciled to ensure that emissions at the surface 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 CO_2 is emitted by Surface Leakage; and 2) to detect and quantify any emissions that do occur. This section discusses how this monitoring will be conducted and used to quantify the mass of CO_2 Surface Leakage.

Monitoring for Potential CO_2 Emissions from the Reservoir

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 CO_2 Surface Leakage from the subsurface.

Reservoir simulation modeling, confirmed with 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 CO_2 emissions by Surface Leakage may be occurring. Excursions are not necessarily indicators of Surface Leakage; 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 CO_2 Surface 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 record in the computerized maintenance management system (CMMS). This record enables the tracking of progress on investigating potential leaks and, if CO_2 has been emitted by Surface Leakage, to quantify its magnitude.

Likewise, a forecast of the rate and composition of produced fluids is developed using the reservoir simulation model. Each producer well is assigned to a specific SAT and is isolated during each cycle for a well production test. The data from the test results are 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 will be initiated. As in the case of injection pattern monitoring, if the investigation leads to a work order in the CMMS, this record will provide the basis for tracking the outcome of the investigation and if a leak has occurred, recording the quantity Surface Leakage. If a CO_2 release in the flood zone were detected, an investigation would be conducted that would include an appropriate method to quantify the mass of any CO_2 confirmed to have been emitted by Surface Leakage. This might include use of material balance equations based on known injected quantities and monitored pressures in the injection zone to estimate the mass of CO_2 involved.

Generally, it is highly unlikely that a subsurface release at SSAU will lead to CO_2 Surface Leakage. In the unlikely event that there are indications of a potential subsurface release, Oxy would determine the appropriate approach for tracking subsurface release to determine whether there was a risk of CO_2 Surface Leakage, address and remedy the release and quantify any actual CO_2 Surface Leakage. To quantify CO_2 Surface Leakage, the relevant parameters (e.g., the rate, concentration, and duration of CO_2 Surface Leakage) would be either be directly measured or estimated to quantify the release mass. Depending on specific circumstances, these determinations may rely on engineering estimates.

In the event a release from the subsurface occurred diffusely through the seals to the surface, the CO_2 Surface Leakage would necessarily include H_2S, which is also present in the SSAU, which would trigger the alarm on the personal monitors worn by field personnel. CO_2 Leakage from the subsurface to the surface have not occurred in the SSAU. If CO_2 Surface Leakage was detected, personnel would use modeling, engineering estimates, and direct measurements to assess, address, and quantify the mass of CO_2 Surface Leakage.

Monitoring of Wellbores

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

CO_2 Surface Leakage from wellbores would be detected through the follow-up investigation of pressure anomalies, visual inspection, or the use of personal H_2S monitors.

Anomalies in injection zone pressure may not indicate that CO_2 Surface Leakage. However, if an investigation leads to a work order, field personnel would inspect the equipment in question and determine the nature of the problem. Where possible, repairs will be made with materials on hand and the mass of CO_2 Surface Leakage would be included in the 40 CFR Part 98 Subpart W report for the SSAU. If repairs require additional time and materials, the appropriate approach for quantifying mass of CO_2 Surface Leakage using the relevant parameters (e.g., the rate, concentration, and duration) 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 any identified issues. Where possible, repairs will be made with materials on hand at the time of inspection and the mass of CO_2 Surface Leakage would be included in the 40 CFR Part 98 Subpart W report for SSAU. If repairs require additional time and materials, the affected well would be shut in, a work order would be generated, and the appropriate approach for quantifying the mass of CO_2 Surface Leakage using the relevant parameters (e.g., the rate, concentration, and duration) would be determined. The work order would serve as the basis for tracking the event for GHG reporting.

Because a CO_2 release 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 SSAU is employed to detect unexpected releases from wellbores and surface facilities. 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 CO_2 emissions.

Finally, the data collected by the H_2S monitors, which are worn by all field personnel at all times, are used as an additional method to detect CO_2 Surface Leakage from wellbores. The H_2S monitors' detection limit is 10 ppm; if an H_2S 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, H_2S is considered a proxy for potential CO_2 Surface Leakage in the field; thus, detected H_2S will be investigated to determine any if confirmed CO_2 Surface Leakage is occurring. If the incident results in a work order, this will serve as the basis for tracking the event for GHG reporting.

Other Potential CO_2 Emissions by Surface Leakage

The same visual inspection process and H_2S monitoring system for identifying potential CO_2 Surface Leakage s from wellbores will be used to detect other potential CO_2 Surface Leakage. Routine visual inspections are used to detect CO_2 Surface Leakage. 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 conducting a general observation of the facility for visible CO_2 emissions. If problems are detected, field personnel would investigate, and, if maintenance is required, generate a work order in the CMMS, which is tracked through completion. In addition to these visual inspections, the results of the personal H_2S monitors worn by field personnel will be used as a supplement for to identify CO_2 Surface Leakage that may escape visual detection.

If CO_2 Surface Leakage are detected, they will be reported to surface operations personnel, who will review the reports and conduct a site investigation. If maintenance is required, steps will be taken to prevent further emissions, and a work order will be generated in the CMMS. The work order will describe the appropriate corrective action and be used to track completion of the maintenance action. It will also serve as the basis for tracking the event for GHG reporting and quantifying the mass of CO_2 Surface Leakage:

- CO_2 emitted from equipment leaks and vented emissions of CO_2 from surface equipment located between the injection flow meter and the injection wellhead:
    - Oxy evaluates and estimates CO_2 emitted from equipment leaks, the CO_2 content of produced oil, and vented CO_2, as required under 40 CFR Part 98 Subpart W.
- CO_2 emitted from equipment leaks and vented emissions of CO_2 from surface equipment located between the production flow meter and the production wellhead:
    - Oxy evaluates and estimates CO_2 emitted from equipment leaks, the CO_2 content of produced oil, and vented CO_2, as required under 40 CFR Part 98 Subpart W.

6.2. To Show Injected CO_2 Is Not Expected to Migrate to the Surface

At the end of the specified period, Oxy will cease injecting CO_2 for the subsidiary purpose of establishing the long-term storage of CO_2 in the SSAU. 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 CO_2 reported under 40 CFR §98.440-449 (Subpart RR) is not expected to migrate in the future in a manner likely to result in CO_2 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:

- Data comparing actual performance to predicted performance (purchase, injection, production) over the monitoring period;
- An assessment of the CO_2 Surface Leakage detected, including discussion of the estimated mass of CO_2 emitted and the distribution of emissions by Surface Leakage pathway;
- A demonstration that future operations will not release the injected CO_2 to the surface;
- A demonstration that there has been no significant CO_2 emissions by Surface Leakage and,
- An evaluation of reservoir pressure that demonstrates that injected fluids are not expected to migrate in a manner to likely to result in Surface Leakage.

7. Determination of Baselines

Existing automatic data systems will be utilized to identify and investigate excursions from expected performance that could indicate CO_2 emissions from the SSAU. Data systems are used primarily for operational control and monitoring and thus 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 CO_2 Surface Leakage will be developed. The following describes the approach to collecting this information.

7.1 Visual Inspections

As field personnel conduct routine inspections, work orders are generated in the CMMS for maintenance activities that cannot be addressed on the spot. Methods to capture work orders that involve activities that could potentially involve CO_2 Surface 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 mass of CO_2 Surface Leakage. Records of information used to calculate emissions will be maintained on file for a minimum of three years.

7.2 Personal H_2S Monitors

Oxy's injection gas compositional analysis indicates H_2S is approximately 1% of the total injected fluid stream.

H_2S monitors are worn by all field personnel. The H_2S monitors detect concentrations of H_2S up to 500 ppm in 0.1 ppm increments and will sound an alarm if the detection limit exceeds 10 ppm. If an H_2S 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 H_2S to be a proxy for identifying CO_2 Surface Leakage. The person responsible for MRV documentation will receive notice of all incidents where H_2S 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 of the mass of CO_2 confirmed emitted from any such incidents. Records of information to calculate emissions will be maintained on file for a minimum of three years.

7.3 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 reservoir modeling. The injection targets are programmed into the WAG satellite controllers. High and low set points are also programmed into the controllers, and flags are generated whenever statistically significant deviations from these 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 lead to CO_2 Surface Leakage. The person responsible for the MRV documentation will receive notice of excursions and related work orders that could potentially involve CO_2 Surface Leakage. The Annual Subpart RR Report will provide an estimate of the mass of CO_2 confirmed Surface

Leakage. Records of information used to calculate emissions will be maintained on file for a minimum of three years.

7.4 Production Volumes and Compositions

A general forecast of production volumes and composition is developed and used to evaluate performance periodically and refine current and projected injection plans and the forecast. This information is used to make operational decisions, but it is not recorded in an automated data system. Sometimes, this review may result in the generation of a work order in the CMMS. The MRV plan implementation lead will review such work orders and identify those that could result in CO_2 Surface Leakage. Should such events occur, the mass of CO_2 confirmed Surface Leakage 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, Oxy proposed and will 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 avoids propagating significant errors that would occur if data were taken from the individual wellhead meters within the SSAU.

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

8.1 Mass of CO_2 Received

Equation RR-2 will be used as indicated in Subpart RR §98.443 to calculate the mass of CO_2 at the receiving custody transfer meter from the Permian Basin CO_2 pipeline delivery system. The volumetric flow at standard conditions will be multiplied by the CO_2 concentration and the density of CO_2 at standard conditions to determine net annual mass of CO_2 received.

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

where:

$CO_{2T,r}$ = Net annual mass of CO_2 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 CO_2 at standard conditions (metric tons per standard cubic meter), 0.0018682;

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

p = Quarter of the year; and

r = Receiving flow meters.

Given SSAU's method of receiving CO_2 and requirements at Subpart RR §98.444(a):

- All delivery to the SSAU is used within the unit so no quarterly flow is redelivered, and $S_{r,p}$ will be zero (0); and
- Quarterly CO_2 concentration will be taken from the gas measurement database (See Section 10.1.5 below).

The mass of CO_2 received from all flow meters is calculated in the following equation.

$$CO_2 = \sum_{r=1}^{R} CO_{2T,r} \qquad \text{(Eq. RR-3)}$$

where:

CO_2 = Total net annual mass of CO_2 received (metric tons).

$CO_{2T,r}$ = Net annual mass of CO_2 received through flow meter r (metric tons).

8.2 Mass of CO_2 Injected into the Subsurface

The equation for calculating the Mass of CO_2 Injected into the Subsurface at the SSAU is equal to the sum of the Mass of CO_2 Received as calculated in RR-2 of §98.443 (Section 8.1 above) and the Mass of CO_2 Recycled calculated using measurements taken from the flow meter located at the output of the SGPP (see M3 on Figure 5). This is the preferred method because, 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 CO_2 Recycled will be determined using equations RR-5 as follows:

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

where:

$CO_{2,u}$ = Annual CO_2 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 CO_2 at standard conditions (metric tons per standard cubic meter), 0.0018682;

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

p = Quarter of the year; and

u = Flow meter.

The total Mass of CO_2 Injected (RR-6) will be the sum of the Mass of CO_2 Received (RR-3) and Mass of CO_2 Recycled (RR-5).

$$CO_{2I} = \sum_{u=1}^{U} CO_{2,u} \qquad \text{(Eq. RR-6)}$$

where:

$CO_{2,u}$ = Annual CO_2 mass recycled (metric tons) as measured by flow meter u + Net annual mass of CO_2 received through flow meter r (metric tons).

8.3 Mass of CO_2 Produced

The Mass of CO_2 Produced at the SSAU will be calculated using the measurements from the flow meter at the inlet to SGPP (M7) and the custody transfer meter for oil sales (M4) rather than the metered data from each production well. Again, this is appropriate because 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 Annual CO_2 mass produced from all production wells as follows:

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

Where:

CO_{2w} = Annual CO_2 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 CO_2 at standard conditions (metric tons per standard cubic meter), 0.0018682;
$C_{CO_2,p,w}$ = CO_2 concentration measurement in flow for meter w in quarter p (vol. percent CO_2, expressed as a decimal fraction);
p = Quarter of the year; and
w = inlet meter to SGPP.

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

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

Where:

$CO_{2,p}$ = Total annual CO_2 mass produced (metric tons) through all meters in the reporting year;

$CO_{2,w}$ = Annual CO_2 mass produced (metric tons) through meter w in the reporting year;

X_{oil} = Mass of entrained CO_2 in oil in the reporting year measured utilizing commercial meters and electronic flow-measurement devices at each point of custody transfer. The mass of CO_2 will be calculated by multiplying the total volumetric rate by the CO_2 concentration; and

8.4 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 events and relies on 40 CFR Part 98 Subpart W reports of CO_2 emitted from equipment leaks. Oxy is prepared to address the potential for CO_2 Surface Leakage in a variety of settings. Estimates of the mass of confirmed CO_2 Surface Leakage will depend on a number of site-specific factors including measurements, engineering estimates, and emission factors, depending on the source and nature of the CO_2 Surface Leakage.

The process for quantifying the mass of CO_2 Surface Leakage will entail using best engineering principles or emission factors. While it is not possible to predict in advance all the types of events that may lead to CO_2 Surface Leakage, some approaches for quantification are described in Sections 5.9 and 6. In the event CO_2 Surface Leakage is confirmed the mass of CO_2 Surface Leakage would be quantified and reported, and records that describe the methods used to estimate or measure the mass emitted 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 the mass of CO_2 Surface Leakage are not double-counted.

Equation RR-10 in 48.433 will be used to calculate and report the Annual Mass of CO_2 Emitted by Surface Leakage:

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

where:

CO_{2E} = Total annual CO_2 mass emitted by Surface Leakage (metric tons) in the reporting year;

CO_{2x} = Annual CO_2 mass emitted (metric tons) at leakage pathway x in the reporting year; and

x = Leakage pathway.

8.5 Mass of CO_2 Sequestered in Subsurface Geologic Formation

Equation RR-11 in 98.443 will be used to calculate the Mass of CO_2 Sequestered in Subsurface Geologic Formations in the Reporting Year as follows:

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

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) net of CO_2 entrained (i.e., dissolved) in oil 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; and

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.

8.6 Cumulative Mass of CO_2 Reported as Sequestered in Subsurface Geologic Formation

The total annual mass obtained using equation RR-11 in 98.443 will be summed to arrive at the Cumulative Mass of CO_2 Sequestered in Subsurface Geologic Formations.

9. MRV Plan Implementation Schedule

This MRV plan will be implemented starting January 2023 or within 90 days of EPA approval, whichever occurs later. GHG reports are filed on March 31 of the year after the reporting year, and Oxy anticipates that the Annual Subpart RR Report will be filed at the same time. Oxy anticipates that the MRV program will be in effect during the specified period, during which time one of the operating purposes will be to establish long-term containment of a measurable quantity of CO_2 in subsurface geological formations at the SSAU. Oxy anticipates that it will be able to demonstrate that a quantifiable mass of CO_2 injected during the specified period will be stored such that it will not migrate in the future in a manner that likely to result in Surface Leakage. At the end of the specified period, 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:

<u>10.1.1 CO_2 Received and Injected</u>

- The quarterly flow rate of CO_2 received by pipeline is measured at the receiving custody transfer meters.

- The quarterly CO_2 flow rate for recycled CO_2 is measured at the flow meter located at the SGPP outlet.

10.1.2 CO_2 Produced

- The point of measurement for the quantity of CO_2 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 SGPP flow meter used to measure flow rate of the gas stream, and the CO_2 concentration of the sample will be measured.
- The quarterly flow rate of the produced gas is measured at the flow meters located at the SGPP inlet.

10.1.3 CO_2 Emissions from Equipment Leaks and Vented Emissions of CO_2

The mass of CO2 emitted from equipment leaks and vented emissions are measured in conformance with the monitoring and QA/QC requirements specified in Subpart W of 40 CFR Part 98.

10.1.4 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 either industry standard practices or an appropriate standard method published by a consensus-based standards organization; and,
- Calibrated, when necessary, using National Institute of Standards and Technology (NIST) methods that are traceable.

10.1.5 Concentration of CO_2

CO_2 concentration is measured using an industry standard practice or an appropriate standard method. Further, all measured CO_2 has been converted to standard cubic meters at a temperature of 60°F 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 CO_2 received that is missing will be estimated using invoices or using a representative flow rate value from the nearest previous time period.
- A quarterly CO_2 concentration of a CO_2 stream received that is missing will be estimated using invoices or using a representative concentration value from the nearest previous time period.
- A quarterly quantity of CO_2 injected that is missing will be estimated using a representative quantity of CO_2 injected from the nearest previous period of time at a similar injection pressure.

- For any values associated with CO_2 emissions from equipment leaks and vented emissions of CO_2 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 will be followed.
- The quarterly quantity of CO_2 produced from subsurface geologic formations that is missing will be estimated using a representative quantity of CO_2 produced from the nearest previous period of time.

10.3 MRV Plan Revisions

Within 180 days of a material change to the monitoring and/or operational parameters of the CO_2 EOR operations in the SSAU that is not anticipated in this MRV plan, a change in UIC permit class, EPA notification of substantive errors in this MRV plan or monitoring report, or if Oxy chooses to revise this MRV plan, the MRV plan will be revised and submitted to the EPA Administrator 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 CO_2 received at standard conditions and operating conditions, operating temperature and pressure, and concentration of these streams.
- Quarterly records of produced CO_2, including volumetric flow at standard conditions and operating conditions, operating temperature and pressure, and concentration of these streams.
- Quarterly records of injected CO_2 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 CO_2 emitted by Surface Leakage.
- 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 flow meter used to measure injection quantity and the injection wellhead.
- 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 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

Table 4 presents the well name and number, API number, type, and status for active wells in SSAU 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 CO_2 gas.
  - INJ_WAG refers to wells that inject water and CO_2 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.

Table 4—SSAU Well Numbers, Types, and Status

The Well Name & Number, API Number, Well Type, and Well Status are all from OXYODS.MDMODS.Well_All. They include only Oxy Operated wells with a field name like SEMINOLE (SAN ANDRES).

Well Name & Number from OXYODS	API Number	Well Type	Well Status as of November 2022
SSAU-3901	42165000220000	INJ_WAG	ACTIVE
SSAU-1301	42165000230000	PROD_OIL	ACTIVE
SSAU-0701	42165000240000	PROD_OIL	ACTIVE
SSAU-3902	42165000250000	INJ_WAG	ACTIVE
SSAU-1302	42165000260000	INJ_WAG	ACTIVE
SSAU-0702	42165000270000	INJ_WAG	ACTIVE
SSAU-3903	42165000290000	PROD_OIL	P & A
SSAU-1303	42165000300000	PROD_OIL	TA
SSAU-0703	42165000310000	PROD_OIL	ACTIVE
SSAU-3904	42165000320000	PROD_OIL	ACTIVE
SSAU-1304	42165000330000	PROD_OIL	ACTIVE
SSAU-0704	42165000340000	PROD_OIL	P & A
SSAU-3905W	42165000350000	INJ_WAG	ACTIVE
SSAU-0705	42165000360000	PROD_OIL	ACTIVE
SSAU-3906	42165000370000	PROD_OIL	ACTIVE
SSAU-1306	42165000380000	INJ_WAG	ACTIVE
SSAU-0706	42165000390000	INJ_H2O	ACTIVE
SSAU-3907	42165000400000	PROD_OIL	ACTIVE
SSAU-0707	42165000410000	INJ_H2O	ACTIVE
SSAU-3908	42165000420000	INJ_WAG	ACTIVE
SSAU-1102	42165000520000	INJ_WAG	P & A
SSAU-1202	42165000650000	PROD_OIL	ACTIVE
SSAU-3602	42165000660000	PROD_OIL	TA
SSAU-4801	42165000670000	PROD_OIL	ACTIVE
SSAU-1201	42165000690000	INJ_H2O	P & A
SSAU-4302	42165000720000	PROD_OIL	ACTIVE
SSAU-4303W	42165000730000	INJ_WAG	ACTIVE
SSAU-4304	42165000740000	INJ_WAG	ACTIVE
SSAU-4305	42165000750000	INJ_WAG	ACTIVE
SSAU-4306	42165000760000	INJ_WAG	ACTIVE
SSAU-4307	42165000770000	INJ_WAG	ACTIVE
SSAU-4308	42165000780000	INJ_WAG	ACTIVE
SSAU-4309	42165000790000	PROD_OIL	TA
SSAU-0401	42165000820000	INJ_H2O	ACTIVE

SSAU-0501	42165000830000	INJ_H2O	ACTIVE
SSAU-0402	42165000840000	PROD_OIL	P & A
SSAU-0502	42165000850000	PROD_OIL	ACTIVE
SSAU-0801	42165000980000	PROD_OIL	ACTIVE
SSAU-3501W	42165000990000	INJ_H2O	TA
SSAU-3502	42165001000000	PROD_OIL	ACTIVE
SSAU-3503	42165001010000	INJ_WAG	ACTIVE
SSAU-3504	42165001020000	INJ_WAG	SHUT-IN
SSAU-3505	42165001030000	INJ_WAG	ACTIVE
SSAU-3506	42165001040000	PROD_OIL	TA
SSAU-3507W	42165001050000	INJ_WAG	ACTIVE
SSAU-3508	42165001060000	PROD_OIL	ACTIVE
SSAU-3509	42165001070000	INJ_WAG	SHUT-IN
SSAU-3510	42165001080000	INJ_WAG	TA
SSAU-3511	42165001090000	INJ_WAG	ACTIVE
SSAU-3512	42165001100000	PROD_OIL	P & A
SSAU-3513W	42165001110000	INJ_WAG	ACTIVE
SSAU-3514	42165001120000	INJ_WAG	ACTIVE
SSAU-3515	42165001130000	PROD_OIL	P & A
SSAU-3516	42165001140000	PROD_OIL	TA
SSAU-6401	42165001700000	PROD_OIL	ACTIVE
SSAU-6402	42165001710000	INJ_WAG	ACTIVE
SSAU-6403	42165001720000	PROD_OIL	ACTIVE
SSAU-6404	42165001730000	PROD_OIL	ACTIVE
SSAU-6405	42165001740000	PROD_OIL	ACTIVE
SSAU-6406W	42165001750000	INJ_H2O	TA
SSAU-6407	42165001760000	PROD_OIL	ACTIVE
SSAU-2401W	42165001880000	INJ_WAG	ACTIVE
SSAU-2402	42165001890000	PROD_OIL	ACTIVE
SSAU-2403	42165001900000	PROD_OIL	ACTIVE
SSAU-2404	42165001910000	INJ_WAG	ACTIVE
SSAU-6001	42165001920000	PROD_OIL	TA
SSAU-5301	42165001930000	INJ_WAG	ACTIVE
SSAU-5302	42165001940000	PROD_OIL	ACTIVE
SSAU-5303	42165001950000	PROD_OIL	ACTIVE
SSAU-5304W	42165001960000	INJ_WAG	ACTIVE
SSAU-5305	42165001970000	INJ_WAG	ACTIVE
SSAU-5306	42165001980000	PROD_OIL	ACTIVE
SSAU-5307	42165001990000	PROD_OIL	ACTIVE
SSAU-5308W	42165002000000	INJ_WAG	P & A
SSAU-2701	42165002040000	INJ_WAG	ACTIVE

SSAU-2702	42165002050000	PROD_OIL	ACTIVE
SSAU-2703W	42165002060000	INJ_WAG	ACTIVE
SSAU-2704W	42165002070000	INJ_WAG	ACTIVE
SSAU-2705	42165002080000	PROD_OIL	ACTIVE
SSAU-2706	42165002090000	PROD_OIL	ACTIVE
SSAU-2707	42165002160000	INJ_WAG	ACTIVE
SSAU-2708	42165002170000	PROD_OIL	ACTIVE
SSAU-0601	42165002270000	INJ_H2O	ACTIVE
SSAU-4001	42165002290000	PROD_OIL	P & A
SSAU-1401	42165002300000	PROD_OIL	ACTIVE
SSAU-3701	42165002310000	INJ_WAG	ACTIVE
SSAU-4002W	42165002320000	INJ_WAG	ACTIVE
SSAU-1402W	42165002330000	INJ_H2O	P & A
SSAU-3702	42165002340000	PROD_OIL	ACTIVE
SSAU-4003	42165002350000	INJ_H2O	P & A
SSAU-1403	42165002360000	INJ_WAG	ACTIVE
SSAU-4004	42165002370000	PROD_OIL	ACTIVE
SSAU-1404	42165002380000	PROD_OIL	ACTIVE
SSAU-4005	42165002390000	INJ_H2O	P & A
SSAU-1405	42165002400000	PROD_OIL	ACTIVE
SSAU-4006	42165002410000	PROD_OIL	ACTIVE
SSAU-1406	42165002420000	INJ_WAG	ACTIVE
SSAU-4007	42165002430000	PROD_OIL	INACTIVE
SSAU-1407	42165002440000	PROD_OIL	ACTIVE
SSAU-4008	42165002450000	INJ_WAG	ACTIVE
SSAU-1408	42165002460000	INJ_H2O	P & A
SSAU-3601	42165002520000	INJ_H2O	TA
SSAU-1504	42165002570000	PROD_OIL	ACTIVE
SSAU-1505W	42165002580000	INJ_WAG	P & A
SSAU-1506	42165002590000	INJ_WAG	ACTIVE
SSAU-1507	42165002600000	PROD_OIL	ACTIVE
SSAU-5901	42165002630000	PROD_OIL	ACTIVE
SSAU-5902	42165002640000	PROD_OIL	TA
SSAU-3801	42165002690000	INJ_WAG	INACTIVE
SSAU-3802	42165002700000	PROD_OIL	INACTIVE
SSAU-3803	42165002710000	PROD_OIL	P & A
SSAU-3804	42165002720000	PROD_OIL	ACTIVE
SSAU-3805	42165002730000	PROD_OIL	INACTIVE
SSAU-3806	42165002740000	INJ_H2O	ACTIVE
SSAU-1901	42165002800000	PROD_OIL	ACTIVE
SSAU-1902	42165002820000	INJ_WAG	ACTIVE

SSAU-1903	42165002830000	PROD_OIL	ACTIVE
SSAU-1904	42165002840000	PROD_OIL	ACTIVE
SSAU-1905A	42165002850000	PROD_OIL	ACTIVE
SSAU-3301	42165002920000	INJ_WAG	P & A
SSAU-3302	42165002930000	PROD_OIL	ACTIVE
SSAU-3303	42165002940000	INJ_WAG	INACTIVE
SSAU-3304	42165002950000	PROD_OIL	ACTIVE
SSAU-1801	42165003180000	INJ_WAG	ACTIVE
SSAU-1305	42165003400000	PROD_OIL	P & A
SSAU-6408	42165003410000	INJ_H2O	ACTIVE
SSAU-0201	42165003420000	PROD_OIL	TA
SSAU-0202	42165003430000	INJ_H2O	INACTIVE
SSAU-5101	42165003440000	INJ_WAG	ACTIVE
SSAU-5102	42165003450000	INJ_WAG	ACTIVE
SSAU-5103	42165003460000	PROD_OIL	ACTIVE
SSAU-1501	42165003620000	PROD_OIL	ACTIVE
SSAU-1502	42165003630000	INJ_WAG	ACTIVE
SSAU-1503	42165003690000	PROD_OIL	TA
SSAU-6301	42165003870000	PROD_OIL	ACTIVE
SSAU-6302	42165003880000	PROD_OIL	ACTIVE
SSAU-6303	42165003890000	PROD_OIL	ACTIVE
SSAU-6304	42165003900000	INJ_WAG	ACTIVE
SSAU-6305	42165003910000	INJ_H2O	ACTIVE
SSAU-6306	42165003920000	PROD_OIL	ACTIVE
SSAU-6307	42165003930000	INJ_H2O	ACTIVE
SSAU-6308	42165003940000	PROD_OIL	INACTIVE
SSAU-7301	42165004090000	PROD_OIL	ACTIVE
SSAU-7302	42165004100000	PROD_OIL	ACTIVE
SSAU-8201	42165004110000	PROD_OIL	INACTIVE
SSAU-8202	42165004120000	PROD_OIL	P & A
SSAU-8203	42165004130000	PROD_OIL	P & A
SSAU-7701	42165004140000	PROD_OIL	ACTIVE
SSAU-7702	42165004150000	INJ_H2O	ACTIVE
SSAU-8101	42165004160000	PROD_OIL	INACTIVE
SSAU-8102	42165004170000	PROD_OIL	ACTIVE
SSAU-8103	42165004180000	PROD_OIL	INACTIVE
SSAU-8104	42165004190000	INJ_H2O	ACTIVE
SSAU-7401W	42165004230000	INJ_H2O	P & A
SSAU-6101	42165004240000	PROD_OIL	ACTIVE
SSAU-4501	42165008710000	PROD_OIL	P & A
SSAU-8401	42165009570000	INJ_H2O	P & A

SSAU-5601	42165009880000	PROD_OIL	ACTIVE
SSAU-5602	42165009890000	PROD_OIL	P & A
SSAU-5603	42165009900000	PROD_OIL	P & A
SSAU-3001	42165011170000	PROD_OIL	INACTIVE
SSAU-0301	42165011180000	PROD_OIL	P & A
SSAU-3401W	42165011950000	INJ_WAG	ACTIVE
SSAU-3402	42165012040000	PROD_OIL	ACTIVE
SSAU-3403	42165012050000	PROD_OIL	ACTIVE
SSAU-3404	42165012060000	INJ_WAG	ACTIVE
SSAU-2807	42165012130000	PROD_OIL	ACTIVE
SSAU-2808	42165012140000	INJ_WAG	ACTIVE
SSAU-1601	42165012320000	INJ_WAG	ACTIVE
SSAU-1602	42165012330000	PROD_OIL	ACTIVE
SSAU-1603	42165012340000	PROD_OIL	ACTIVE
SSAU-1604	42165012350000	INJ_WAG	ACTIVE
SSAU-1605	42165012360000	PROD_OIL	ACTIVE
SSAU-1606W	42165012370000	INJ_WAG	ACTIVE
SSAU-1607	42165012380000	PROD_OIL	ACTIVE
SSAU-1608	42165012390000	INJ_WAG	ACTIVE
SSAU-2601	42165012430000	PROD_OIL	P & A
SSAU-2501	42165012770000	PROD_OIL	ACTIVE
SSAU-2801	42165012830000	PROD_OIL	P & A
SSAU-2802	42165012840000	INJ_WAG	SHUT-IN
SSAU-2803	42165012850000	PROD_OIL	ACTIVE
SSAU-2804	42165012860000	INJ_WAG	ACTIVE
SSAU-2805W	42165012870000	INJ_WAG	ACTIVE
SSAU-2806	42165012880000	PROD_OIL	ACTIVE
SSAU-0903	42165014280000	INJ_WAG	P & A
SSAU-0902	42165014290000	PROD_OIL	P & A
SSAU-0901W	42165014300000	INJ_WAG	P & A
SSAU-5701	42165014410000	PROD_OIL	P & A
SSAU-0101	42165015120000	INJ_H2O	TA
SSAU-2001	42165015590000	PROD_OIL	P & A
SSAU-0102	42165015620000	PROD_OIL	P & A
SSAU-2202	42165015770000	PROD_OIL	ACTIVE
SSAU-7512	42165015790000	PROD_OIL	P & A
SSAU-5516	42165015800000	INJ_WAG	ACTIVE
SSAU-4101	42165017730000	INJ_WAG	ACTIVE
SSAU-6501	42165017790000	PROD_OIL	P & A
SSAU-6502	42165017800000	INJ_H2O	P & A
SSAU-6503	42165017810000	PROD_OIL	P & A

SSAU-7501	42165017830000	PROD_OIL	ACTIVE
SSAU-7502	42165017840000	PROD_OIL	INACTIVE
SSAU-7503	42165017850000	PROD_OIL	P & A
SSAU-7504	42165017860000	PROD_OIL	ACTIVE
SSAU-7505	42165017870000	PROD_OIL	ACTIVE
SSAU-7506W	42165017880000	INJ_H2O	ACTIVE
SSAU-7507W	42165017890000	INJ_H2O	ACTIVE
SSAU-7508	42165017900000	PROD_OIL	ACTIVE
SSAU-7509	42165017910000	PROD_OIL	INACTIVE
SSAU-7510	42165017920000	PROD_OIL	ACTIVE
SSAU-7511	42165017930000	INJ_H2O	ACTIVE
SSAU-5501	42165017940000	PROD_OIL	ACTIVE
SSAU-5502	42165017950000	INJ_WAG	ACTIVE
SSAU-5503	42165017960000	PROD_OIL	P & A
SSAU-5504W	42165017970000	INJ_WAG	ACTIVE
SSAU-5505	42165017980000	PROD_OIL	P & A
SSAU-5506	42165017990000	INJ_WAG	ACTIVE
SSAU-5507	42165018000000	PROD_OIL	ACTIVE
SSAU-5508	42165018010000	INJ_WAG	ACTIVE
SSAU-5509	42165018020000	INJ_WAG	ACTIVE
SSAU-5510	42165018030000	PROD_OIL	ACTIVE
SSAU-5511W	42165018040000	INJ_WAG	ACTIVE
SSAU-5512	42165018050000	PROD_OIL	P & A
SSAU-5513	42165018060000	PROD_OIL	TA
SSAU-5514	42165018070000	PROD_OIL	P & A
SSAU-5515	42165018080000	PROD_OIL	P & A
SSAU-2901	42165018090000	PROD_OIL	ACTIVE
SSAU-2902	42165018100000	INJ_WAG	ACTIVE
SSAU-2903	42165018110000	PROD_OIL	P & A
SSAU-2904W	42165018120000	INJ_WAG	ACTIVE
SSAU-2905	42165018130000	INJ_WAG	SHUT-IN
SSAU-2906	42165018140000	INJ_WAG	ACTIVE
SSAU-2907	42165018150000	PROD_OIL	ACTIVE
SSAU-2908	42165018160000	INJ_WAG	ACTIVE
SSAU-2909	42165018170000	INJ_WAG	TA
SSAU-2910	42165018180000	PROD_OIL	ACTIVE
SSAU-2911	42165018190000	PROD_OIL	TA
SSAU-2912	42165018200000	PROD_OIL	ACTIVE
SSAU-2913W	42165018210000	INJ_H2O	INACTIVE
SSAU-2914	42165018220000	INJ_H2O	ACTIVE
SSAU-4102	42165018230000	PROD_OIL	ACTIVE

SSAU-4103	42165018240000	PROD_OIL	ACTIVE
SSAU-4104W	42165018250000	INJ_WAG	ACTIVE
SSAU-4105	42165018260000	PROD_OIL	ACTIVE
SSAU-4106	42165018270000	PROD_OIL	TA
SSAU-4107	42165018280000	INJ_WAG	ACTIVE
SSAU-4108W	42165018290000	INJ_WAG	ACTIVE
SSAU-4109	42165018300000	PROD_OIL	ACTIVE
SSAU-4110	42165018310000	INJ_WAG	ACTIVE
SSAU-4111	42165018320000	PROD_OIL	ACTIVE
SSAU-4114	42165018330000	INJ_WAG	ACTIVE
SSAU-4116	42165018340000	INJ_WAG	ACTIVE
SSAU-4115	42165018350000	PROD_OIL	ACTIVE
SSAU-4112	42165018360000	INJ_WAG	ACTIVE
SSAU-4113	42165018370000	PROD_OIL	P & A
SSAU-6201	42165018380000	INJ_WAG	ACTIVE
SSAU-6202	42165018390000	PROD_OIL	ACTIVE
SSAU-6203	42165018400000	INJ_WAG	ACTIVE
SSAU-6204	42165018410000	INJ_H2O	ACTIVE
SSAU-6205	42165018420000	PROD_OIL	ACTIVE
SSAU-6206	42165018430000	PROD_OIL	ACTIVE
SSAU-6208	42165018440000	PROD_OIL	P & A
SSAU-6209	42165018450000	INJ_H2O	ACTIVE
SSAU-6210	42165018460000	PROD_OIL	ACTIVE
SSAU-3101	42165018470000	PROD_OIL	ACTIVE
SSAU-3102	42165018480000	INJ_WAG	ACTIVE
SSAU-3103	42165018490000	PROD_OIL	ACTIVE
SSAU-3107	42165018510000	INJ_WAG	P & A
SSAU-3108	42165018520000	PROD_OIL	ACTIVE
SSAU-3109	42165018530000	PROD_OIL	ACTIVE
SSAU-3110	42165018540000	INJ_H2O	ACTIVE
SSAU-3111	42165018550000	PROD_OIL	ACTIVE
SSAU-3106	42165018560000	INJ_WAG	ACTIVE
SSAU-2204	42165018570000	PROD_OIL	ACTIVE
SSAU-2201	42165018580000	INJ_WAG	ACTIVE
SSAU-2203	42165018590000	INJ_WAG	ACTIVE
SSAU-2205	42165018600000	PROD_OIL	P & A
SSAU-2206	42165018610000	PROD_OIL	ACTIVE
SSAU-2208	42165018620000	INJ_WAG	ACTIVE
SSAU-2207	42165018630000	PROD_OIL	INACTIVE
SSAU-2209	42165018640000	PROD_OIL	ACTIVE
SSAU-2210	42165018650000	INJ_WAG	ACTIVE

SSAU-2211	42165018660000	PROD_OIL	ACTIVE
SSAU-3104	42165018730000	INJ_H2O	P & A
SSAU-6207	42165018740000	PROD_OIL	ACTIVE
SSAU-7601	42165018800000	PROD_OIL	ACTIVE
SSAU-7602	42165018810000	PROD_OIL	ACTIVE
SSAU-7603	42165018820000	INJ_H2O	TA
SSAU-7604	42165018830000	PROD_OIL	P & A
SSAU-7001	42165018870000	PROD_OIL	ACTIVE
SSAU-4901	42165020110000	PROD_OIL	ACTIVE
SSAU-4902	42165020120000	PROD_OIL	P & A
SSAU-4903	42165020130000	PROD_OIL	ACTIVE
SSAU-4904	42165020140000	INJ_WAG	ACTIVE
SSAU-4905	42165020150000	PROD_OIL	ACTIVE
SSAU-3201	42165020170000	PROD_OIL	P & A
SSAU-3202	42165020180000	INJ_WAG	INACTIVE
SSAU-3203	42165020190000	PROD_OIL	ACTIVE
SSAU-3204	42165020200000	INJ_WAG	ACTIVE
SSAU-3205	42165020210000	PROD_OIL	TA
SSAU-3206	42165020220000	INJ_WAG	ACTIVE
SSAU-3207	42165020230000	PROD_OIL	ACTIVE
SSAU-3208	42165020240000	INJ_WAG	ACTIVE
SSAU-2301	42165020250000	PROD_OIL	ACTIVE
SSAU-2302	42165020260000	INJ_WAG	ACTIVE
SSAU-2303	42165020270000	PROD_OIL	INACTIVE
SSAU-2304W	42165020280000	INJ_WAG	P & A
SSAU-2305	42165020290000	PROD_OIL	ACTIVE
SSAU-2306	42165020300000	INJ_WAG	ACTIVE
SSAU-2307	42165020310000	PROD_OIL	ACTIVE
SSAU-2308	42165020320000	INJ_WAG	ACTIVE
SSAU-2101	42165020630000	PROD_OIL	ACTIVE
SSAU-1701	42165020650000	PROD_OIL	ACTIVE
SSAU-1702	42165020660000	PROD_OIL	ACTIVE
SSAU-1101	42165020680000	PROD_OIL	ACTIVE
SSAU-1001	42165020690000	PROD_OIL	ACTIVE
SSAU-1002W	42165020700000	INJ_WAG	ACTIVE
SSAU-1003	42165020710000	INJ_WAG	ACTIVE
SSAU-1004	42165020720000	PROD_OIL	ACTIVE
SSAU-1005	42165020730000	PROD_OIL	ACTIVE
SSAU-1006W	42165020740000	INJ_WAG	ACTIVE
SSAU-1007	42165020750000	PROD_OIL	ACTIVE
SSAU-1008	42165020760000	INJ_WAG	ACTIVE

SSAU-1009	42165020770000	PROD_OIL	ACTIVE
SSAU-1010	42165020790000	INJ_WAG	ACTIVE
SSAU-5201A	42165024290000	PROD_OIL	ACTIVE
SSAU-5202	42165024300000	INJ_WAG	ACTIVE
SSAU-5203	42165024310000	PROD_OIL	P & A
SSAU-5204A	42165024330000	INJ_WAG	ACTIVE
SSAU-5401	42165025670000	PROD_OIL	ACTIVE
SSAU-5402	42165025680000	PROD_OIL	ACTIVE
SSAU-5403	42165025690000	INJ_WAG	P & A
SSAU-5404W	42165025700000	INJ_WAG	ACTIVE
SSAU-4201	42165025740000	INJ_WAG	P & A
SSAU-4202	42165025750000	PROD_OIL	TA
SSAU-4203	42165025760000	INJ_WAG	P & A
SSAU-4204	42165025770000	INJ_WAG	ACTIVE
SSAU-7513	42165025950000	PROD_OIL	P & A
SSAU-3105A	42165025990000	PROD_OIL	P & A
SSAU-2602A	42165028350000	INJ_WAG	ACTIVE
SSAU-2502	42165028520000	INJ_WAG	ACTIVE
SSAU-5801	42165032350000	PROD_OIL	TA
SSAU-5702	42165032360000	PROD_OIL	P & A
SSAU-5704	42165032380000	PROD_OIL	TA
SSAU-5705	42165032390000	INJ_H2O	P & A
SSAU-6901	42165032410000	PROD_OIL	P & A
SSAU-7201	42165033030000	PROD_OIL	ACTIVE
SSAU-5001A	42165033170000	INJ_WAG	ACTIVE
SSAU-2214	42165100130000	PROD_OIL	ACTIVE
SSAU-2603	42165100340000	PROD_OIL	ACTIVE
SSAU-4310	42165100700000	PROD_OIL	P & A
SSAU-1508	42165100770000	PROD_OIL	P & A
SSAU-3703	42165101260000	PROD_OIL	P & A
SSAU-3209	42165101610000	PROD_OIL	ACTIVE
SSAU-1906	42165101920000	PROD_OIL	P & A
SSAU-4311	42165101990000	PROD_OIL	ACTIVE
SSAU-4312	42165102000000	PROD_OIL	TA
SSAU-0503	42165102010000	INJ_H2O	P & A
SSAU-3114W	42165106050000	INJ_H2O	P & A
SSAU-3113	42165106300000	PROD_OIL	P & A
SSAU-6211	42165300130000	INJ_H2O	ACTIVE
SSAU-3807	42165300140000	INJ_H2O	P & A
SSAU-3704	42165300150000	INJ_H2O	ACTIVE
SSAU-0403	42165300160000	INJ_H2O	P & A

SSAU-6212	42165300170000	INJ_H2O	ACTIVE
SSAU-7202	42165300180000	INJ_H2O	INACTIVE
SSAU-4907	42165300540000	INJ_H2O	ACTIVE
SSAU-2213	42165300550000	INJ_H2O	TA
SSAU-0303	42165300560000	INJ_H2O	P & A
SSAU-0603	42165300570000	INJ_H2O	ACTIVE
SSAU-4602	42165301250000	INJ_H2O	TA
SSAU-4401	42165301260000	INJ_H2O	ACTIVE
SSAU-2003	42165301270000	INJ_H2O	INACTIVE
SSAU-1907	42165301280000	INJ_H2O	P & A
SSAU-1802	42165301290000	INJ_H2O	TA
SSAU-4802	42165301300000	INJ_H2O	TA
SSAU-8204	42165301310000	INJ_H2O	TA
SSAU-3105R	42165303490000	PROD_OIL	P & A
SSAU-5514R	42165304820000	INJ_WAG	ACTIVE
SSAU-7514	42165304840000	INJ_H2O	ACTIVE
SSAU-1803	42165304850000	INJ_H2O	ACTIVE
SSAU-2915	42165304890000	PROD_OIL	ACTIVE
SSAU-2405	42165305540000	INJ_WAG	ACTIVE
SSAU-3910	42165305550000	PROD_OIL	P & A
SSAU-2406	42165305660000	PROD_OIL	ACTIVE
SSAU-2505	42165305670000	PROD_OIL	TA
SSAU-2504	42165305680000	INJ_WAG	ACTIVE
SSAU-2310	42165311550000	PROD_OIL	ACTIVE
SSAU-4902R	42165311560000	INJ_WAG	ACTIVE
SSAU-2710	42165311570000	INJ_WAG	ACTIVE
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SSAU-2711	42165312650000	PROD_OIL	ACTIVE
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SSAU-3305	42165313660000	PROD_OIL	ACTIVE
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SSAU-3406	42165313790000	INJ_WAG	ACTIVE
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SSAU-3115	42165314520000	PROD_OIL	ACTIVE
SSAU-3521	42165314660000	INJ_WAG	ACTIVE
SSAU-4313	42165318840000	PROD_OIL	ACTIVE
SSAU-4314	42165318850000	PROD_OIL	P & A
SSAU-4119	42165318860000	INJ_WAG	ACTIVE
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SSAU-6410	42165335190000	PROD_OIL	ACTIVE
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SSAU-1402R	42165339340000	INJ_WAG	ACTIVE
SSAU-2903R	42165339350000	PROD_OIL	ACTIVE
SSAU-4005R	42165339360000	INJ_WAG	ACTIVE
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SSAU-1105	42165340860000	PROD_OIL	TA
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SSAU-1104	42165342300000	PROD_OIL	ACTIVE
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SSAU-3703R	42165386740000	PROD_OIL	ACTIVE
SSAU-4021S	42165386760000	PROD_OIL	ACTIVE

12.2 Regulatory References

Regulations cited in this plan:

1. 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

2. Oil and Gas Procedure Manual: https://www.rrc.texas.gov/oil-and-gas/publications-and-notices/manuals/oil-and-gas-procedure-manual/