TITAN
CARBON SEQUESTRATION

Underground Injection Control – Class VI Permit Application for

Cronos No. 1 and Rhea No. 1

Jefferson County, Texas

SECTION 8 – EMERGENCY AND REMEDIAL RESPONSE PLAN

February 2024

LONQUIST
SEQUESTRATION LLC

SECTION 8 – EMERGENCY AND REMEDIAL RESPONSE PLAN

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8.1 Introduction

This Emergency and Remedial Response Plan (ERRP) for the Titan Carbon Sequestration, LLC (Titan) injection wells Cronos No. 1 and Rhea No. 1, at the Titan Carbon Sequestration Project (Titan Project), was prepared to meet the requirements of Texas Water Code **§27** and Title 16, Texas Administrative Code (TAC) **§5.203 (l)** [Title 40, U.S. Code of Federal Regulations (40 CFR) **§146.94**]. The plan describes potential adverse events that could occur in the development, operation, and post-closure phases of the project and the actions to be taken in the event of such an emergency. This plan will be reviewed and updated annually. Any change in key personnel will also cause the ERRP to be updated immediately.

8.2 Resources/Infrastructure in Area of Review

The Titan Project is [redacted] The proposed location is approximately [redacted] from the nearest freshwater drinking water well (*Appendix C-3*). No permanent structures are in the predicted review area (AOR). If an undocumented artificial penetration is found, the well will be remediated to ensure protection against any possible migration of CO_2. Additionally, two above-zone monitoring (AZM) wells will be installed in the AOR and constructed in a manner to prevent CO_2 from migrating into the Underground Source of Drinking Water (USDW) and surface atmosphere.

The lowermost USDW in the AOR is estimated to be about [redacted] deep in this area. The Groundwater Advisory Unit (GAU) at the Texas Railroad Commission (TRRC) will provide a groundwater determination letter to confirm both the base of usable quality water and the base of the USDW for the specific injection well locations, prior to commencing drilling operations. The GAU determination letter will be obtained prior to the final well design for drilling.

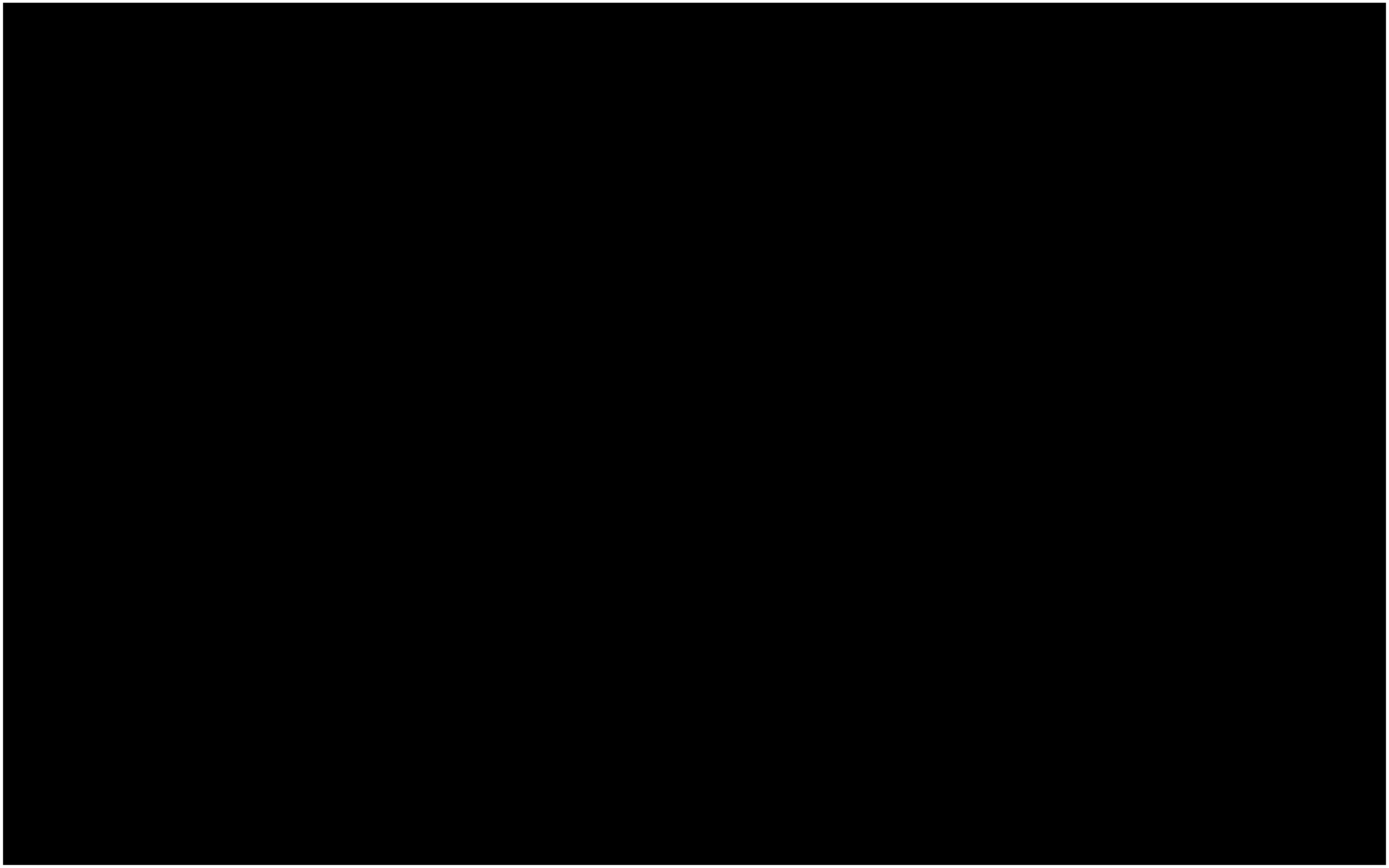

Figure 8-1 – Titan Project Overview Map

8.3 Resources/Infrastructure – Specific Events and Response Plans

The following scenarios represent a high-level concept of potentially significant adverse events, methods of prevention and detection, and likely remedial responses.

8.3.1 Event Category – Water Quality Impact

8.3.1.1 Specific Event Description – Leakage of CO_2 outside permitted area into freshwater aquifer

Risk Assessment Matrix, Sections 1.1 and 1.3 (Appendix F-2)

While this event is unlikely to occur during injection facility operations, Titan cannot wholly eliminate the risk of CO_2 leakage. Similarly, analysis and modeling should help to avoid instances of the plume reaching faults or fractures that allow CO_2 migration into another zone, including the USDW, or to the surface.

Likelihood: Remote

Consequence Severity: High

Prevention and Detection:

- The CO_2 plume will be monitored as described in *Section 5 – Testing and Monitoring Plan*.
- The well is specifically designed, constructed, and operated with components such as CO_2-resistant cement, corrosion-resistant alloy tubulars, and other design factors to reduce the likelihood of a CO_2 leak.

Potential Response Actions:

- Cease injection and notify the Underground Injection Control (UIC) Program director (UIC Director) and other pertinent agencies within 24 hours.
- Use vertical seismic profile (VSP) or seismic surveys to assess the location and degree of CO_2 movement, as described in *Section 5*.
- Resume injection at a reduced rate, if possible to do so, with the approval of the UIC Director.
- Continue monitoring the plume at a more frequent interval to determine if migration continues.
- If groundwater/USDW is impacted (Esposito, 2010):
  - Pump CO_2-impacted groundwater to the surface and aerate it to remove the CO_2.
  - Apply "pump and treat" methods to remove trace elements.
  - Drill wells that intersect the accumulations in groundwater and extract CO_2.
  - Provide an alternative water supply if groundwater-based public-water supplies are impacted.
- If surface water is impacted:
  - Shallow lakes will quickly release dissolved CO_2 back into the atmosphere.
  - Create a hydraulic barrier by increasing the reservoir pressure upstream of the

leak.

- If the plume continues to migrate out of the zone or beyond the expected plume extent, recomplete uphole into the next planned injection stage.

8.3.1.2 Specific Event Description – Leakage of drilling fluid contaminates into potable water aquifer

Risk Assessment Matrix, Section 1.2 (Appendix F-2)

It is possible, albeit unlikely, that drilling fluid could leak during the drilling of the well. In the unlikely event that drilling fluid leaks, it may impact the freshwater aquifer.

Likelihood: Remote

Consequence Severity: Moderate

Prevention and Detection:

- Select a proper drilling-fluids program including freshwater-based muds.
- The well is specifically designed, constructed, and operated with components such as CO_2-resistant cement, corrosion-resistant alloy tubulars, and other design factors to reduce the likelihood of a CO_2 leak.

Potential Response Actions:

- Stop drilling operations and notify the appropriate agencies within 24 hours.
- If groundwater/USDW is impacted (Esposito, 2010):
  - Apply pump-and-treat methods to remove trace elements.
  - Extract and treat affected water at an above-ground treatment facility.
  - Provide an alternative water supply if groundwater-based public water supplies are impacted.

8.3.1.3 Specific Event Description – Seismic event occurs in project area resulting in plume leakage into the USDW

Risk Assessment Matrix, Section 1.4 (Appendix F-2)

If a seismic event were to occur in the project area that creates or opens faults or fractures, such an event could provide a pathway for CO_2 migration into another zone, including the USDW, or to the surface. Failure of the confining zone caused by a seismic event could also cause CO_2 to migrate and contaminate the USDW.

Likelihood: Remote

Consequence Severity: Moderate

Prevention and Detection:

- The CO_2 plume will be monitored as described in *Section 5 – Testing and Monitoring Plan*.

- The chosen project location is both a seismically quiet area and a sufficient distance from nearby shallow faults that could act as a conduit.
- The well is specifically designed, constructed, and operated with components such as CO_2-resistant cement, corrosion-resistant alloy tubulars, and other design factors to reduce the likelihood of a CO_2 leak.

Potential Response Actions:

- Cease injection and notify the UIC Director and other pertinent agencies within 24 hours.
- Use VSP or seismic surveys to assess the location and degree of CO_2 movement, as described in *Section 5*.
- Resume injection at a reduced rate if possible to do so with the approval of the UIC Director and the appropriate agency.
- Continue monitoring the plume at a more frequent interval to determine if migration continues.
- If groundwater/USDW is impacted (Esposito, 2010):
  - Pump CO_2-impacted groundwater to the surface and aerate it to remove the CO_2.
  - Apply pump-and-treat methods to remove trace elements.
  - Drill wells that intersect the accumulations in groundwater and extract the CO_2.
  - Provide an alternative water supply if groundwater-based public-water supplies are impacted.
- If surface water is impacted:
  - Shallow lakes will quickly release dissolved CO_2 back into the atmosphere.
  - Create a hydraulic barrier by increasing the reservoir pressure upstream of the leak.
- If the plume continues to migrate out of the zone or beyond the expected plume extent, recomplete uphole into the next planned injection stage.

8.3.1.4 Specific Event Description – Leakage of brine through artificial penetration into the freshwater aquifer

Risk Assessment Matrix, Section 1.5 (Appendix F-2)

It is possible, albeit unlikely, that brine could leak through an artificial penetration and into the freshwater aquifer. This leakage could occur through a known well included in the AOR, an unknown well that was not in public records, or the injector wells themselves.

Likelihood: Remote

Consequence Severity: Moderate

Prevention and Detection:

- The injector wells and offset USDW wells will be monitored as described in *Section 5*.
- The chosen project location is both a seismically quiet area and a sufficient distance from nearby shallow faults that could act as a conduit.

- The well is specifically designed, constructed, and operated with components such as CO_2-resistant cement, corrosion-resistant alloy tubulars, and other design factors to reduce the likelihood of a brine leak.
- Plugging and abandonment operations for applicable artificial penetrations will be designed and executed with CO_2-resistant cement and monitored as described in *Section 5 – Testing and Monitoring Plan*.
- An aeromagnetic survey will be conducted to ensure no undocumented or unknown wellbores are present.

Potential Response Actions:

- Cease injection and notify the UIC Director and other pertinent agencies within 24 hours.
- Use VSP or seismic surveys to assess the location and degree of brine movement, as described in *Section 5*.
- Resume injection at a reduced rate if possible to do so with the approval of the UIC Director and the appropriate agency.
- Continue monitoring the USDW at a more frequent interval to determine if migration continues.
- If groundwater/USDW is impacted (Esposito, 2010):
  - Install additional safety precautions and measurement devices on the USDW monitoring wells.
  - Drill additional wells to monitor brine impact on the USDW.
  - Provide an alternative water supply if groundwater-based public-water supplies are impacted.
  - Demonstrate mechanical integrity per the methods discussed in *Section 5*.
- If surface water is impacted:
  - Create a hydraulic barrier by increasing the reservoir pressure upstream of the leak.
- If the brine continues to migrate out of the zone or beyond the anticipated extent, recomplete uphole into the next planned injection stage.

8.3.1.5 Specific Event Description – Leakage of methane into freshwater aquifer

Risk Assessment Matrix, Section 1.6 (Appendix F-2)

It is possible, albeit unlikely, that methane could leak through an artificial penetration and into the freshwater aquifer. This leakage could occur through a known well included in the AOR, an unknown well that was not in public records, or the injector wells themselves.

Likelihood: Rare

Consequence Severity: Moderate

Prevention and Detection:

- The injector wells and offset USDW wells will be monitored as described in *Section 5 –*

Testing and Monitoring Plan.

- The chosen project location is both a seismically quiet area and a sufficient distance from nearby shallow faults that could act as a conduit.
- The well is specifically designed, constructed, and operated with components such as CO_2-resistant cement, corrosion-resistant alloy tubulars, and other design factors to reduce the likelihood of a methane leak.
- Plugging and abandonment operations for applicable artificial penetrations will be designed and executed with CO_2-resistant cement and monitored as described in *Section 5*.
- An aeromagnetic survey will be conducted to ensure no undocumented or unknown wellbores are present.

Potential Response Actions:

- Cease injection and notify the UIC Director and other pertinent agencies within 24 hours.
- Use VSP or seismic surveys to assess the location and degree of methane movement, as described in *Section 5*.
- Resume injection at a reduced rate if possible to do so, with the approval of the UIC Director and the appropriate agency.
- Continue monitoring the USDW at a more frequent interval to determine if migration continues.
- If groundwater/USDW is impacted (Esposito, 2010):
  - Install additional safety precautions and measurement devices on the USDW monitoring wells.
  - Drill additional wells to monitor methane impact on the USDW.
  - Provide an alternative water supply if groundwater-based public-water supplies are impacted.
  - Demonstrate mechanical integrity per the methods discussed in *Section 5*.
- If surface water is impacted:
  - Create a hydraulic barrier by increasing the reservoir pressure upstream of the leak.
- If the methane continues to migrate out of the zone or beyond the anticipated extent, recomplete uphole into the next planned injection stage.

8.3.2 Event Category – CO_2 Release to or at the Surface

8.3.2.1 Specific Event Description – Overpressurization (i.e., induced)
Risk Assessment Matrix, Section 2.1 (Appendix F-2)

Although unlikely, overpressurization during injection-facility operations or by operating equipment over designed pressures could cause CO_2 to be released to the surface. This situation could also occur if the maximum allowable operating parameters change due to depreciation or corrosion of equipment, and the changes are not accounted for.

Likelihood: Remote

Consequence Severity: Moderate

Prevention and Detection:

- Proper operation and preventive maintenance of all surface facility equipment will be implemented.
- Tubing and annular pressures will be monitored and maintained below the maximum allowed values.
- Surface wellhead tree will be regularly maintained and tested for integrity.
- Subsurface safety valve will be regularly tested.
- Surface CO_2 detection equipment will be installed.

Potential Response Actions:

- Shut in flow line upon any detection of CO_2 at the surface.
- Cease injection and notify the UIC Director and other pertinent agencies within 24 hours.
- Close the wellhead valve.
- Monitor well and annulus pressures.
- Determine if personnel need to be evacuated from the facility and begin gas-monitoring operations.
- Allow pressure to bleed off the equipment and process system and allow atmospheric gas levels to return to normal.
- Determine the cause and severity of the failure to initiate repairs.
- Demonstrate mechanical integrity per the methods discussed in *Section 5 – Testing and Monitoring Plan*.
- Resume injection at a reduced rate if possible to do so, with the approval of the UIC Director and the appropriate agency.

8.3.2.2 Specific Event Description – Confining zone/reservoir failure

Risk Assessment Matrix, Section 2.2 (Appendix F-2)

Unforeseen geological complications could result in a release of CO_2 to the surface.

Likelihood: Rare

Consequence Severity: Moderate

Prevention and Detection:

- Due diligence will be exercised when collecting information from offset wells in the AOR.
- Pressure and rate monitoring, pressure falloff tests, annulus pressure tests, etc., will all be performed according to *Section 5*.
- Tubing and annular pressures will be monitored and maintained below the maximum allowed values.

- Carbon dioxide detectors will be utilized to continuously monitor ambient air.

Potential Response Actions:

- Shut in flow line upon any detection of CO_2 at the surface.
- Cease injection and notify the UIC Director and other pertinent agencies within 24 hours.
- Close the wellhead valve.
- Monitor well and annulus pressures.
- Determine if personnel need to be evacuated from the facility and begin gas-monitoring operations.
- Allow pressure to bleed off the equipment and process system and allow atmospheric gas levels to return to normal.
- Determine the cause and severity of the failure to initiate repairs.
- Demonstrate mechanical integrity per the methods discussed in *Section 5 – Testing and Monitoring Plan.*
- Resume injection at a reduced rate if possible to do so, with the approval of the UIC Director and the appropriate agency.

8.3.2.3 Specific Event Description – Well blowout during drilling operations or loss of mechanical integrity of the well pressure equipment

Risk Assessment Matrix, Section 2.3 (Appendix F-2)

Although highly unlikely, a well blowout could occur during wellbore drilling if unexpected changes in reservoir pressures cause a sudden release of hydrocarbons, water, and/or pressure from the subsurface formations. The integrity of the well may be lost during injection if there is an unexpected failure in well pressure equipment.

Likelihood: Remote

Consequence Severity: Low

Prevention and Detection:

- Maintain appropriate mud weights as required based on offset well data.
- Monitor the rate of drilling-fluid returns vs. rates pumped, penetration rates, pump pressures, etc.
- Proper wellbore design, including proper cement and metallurgy of the casing and tubing, will be implemented in the construction phase.
- Pressure and rate monitoring, pressure falloff tests, annulus pressure tests, etc., will all be performed according to *Section 5*.
- Surface CO_2 detection equipment will be installed.

Potential Response Actions:

- Stop drilling operations and notify the appropriate agencies within 24 hours.
- Activate the proper blowout prevention equipment.

- Read and record stabilized shut-in pressures.
- Cease injection and notify the UIC Director and other pertinent agencies within 24 hours.
- Kill the well by pumping fluid that is heavier than the current fluid down the wellbore until the well stops flowing.

8.3.2.4 Specific Event Description – Well-seal failure of CO_2 sequestration well

Risk Assessment Matrix, Sections 2.4 and 2.5 (Appendix F-2)

A well-seal failure could occur due to the failure of the cement behind the casing, an improperly seated packer, or a tubing leak. This event could also occur due to the corrosive nature of the CO_2 stream causing a break through the casing, allowing for an escape to surface.

Likelihood: Rare

Consequence Severity: Low

Prevention and Detection:

- Proper wellbore design, including proper cement and metallurgy of the casing and tubing, will be implemented in the construction phase.
- Pressure and rate monitoring, pressure falloff tests, annulus pressure tests, etc., will all be performed according to *Section 5 – Testing and Monitoring Plan*.
- Routine cement bond logs and casing inspection logs will be collected and analyzed.
- Surface CO_2 detection equipment will be installed.

Potential Response Actions:

- Cease injection and notify the UIC Director and other pertinent agencies within 24 hours.
- Close the wellhead valve.
- Monitor well and annulus pressures.
- Determine the cause and severity of failure to determine if the CO_2 stream or formation fluids may have been released into any unauthorized zone.
- Pull and replace the tubing or the packer.
- Install a chemical-sealant barrier and or attempt a cement squeeze to block leaks.
- Demonstrate mechanical integrity per the methods discussed in *Section 5*.
- Resume injection at a reduced rate if possible to do so, with the approval of the UIC Director and the appropriate agency.

8.3.2.5 Specific Event Description – Major mechanical failure of flowlines or distribution system
Risk Assessment Matrix, Section 2.6 (Appendix F-2)

Although highly unlikely, a major mechanical failure of the CO_2 flowlines and distribution system is possible during injection-facility operations by operating equipment (1) outside designed operating parameters, (2) beyond recommended preventive maintenance cycles, or (3) improperly.

Likelihood: Rare

Consequence Severity: Low

Prevention and Detection:

- Operate a closely monitored facility with best operation practices.
- Ensure controls are in place to prevent overpressure and release.
- Proper operation and preventive maintenance of all surface-facility equipment will be carried out.
- Tubing and annular pressures will be monitored and maintained below the maximum allowed values.
- Surface wellhead tree will be regularly maintained and tested for integrity.
- Surface CO_2 detection equipment will be installed.

Potential Response Actions:

- Shut in the flow line upon any detection of CO_2 at the surface.
- Cease injection and notify the UIC Director and other pertinent agencies within 24 hours.
- Close the wellhead valve.
- Monitor well and annulus pressures.
- Determine if personnel need to be evacuated from the facility and begin gas-monitoring operations.
- Allow pressure to bleed off the equipment and process system and allow atmospheric gas levels to return to normal.
- Determine the cause and severity of the failure in order to initiate repairs.
- Demonstrate mechanical integrity per the methods discussed in *Section 5 – Testing and Monitoring Plan*.
- Resume injection at a reduced rate if possible to do so, with the approval of the UIC Director and the appropriate agency.

8.3.2.6 Specific Event Description – Well-seal failure of adjacent wells (i.e., plugged and abandoned wells, monitoring wells) or orphan wells (i.e., wells not identified prior to injection)

Risk Assessment Matrix, Sections 2.7 and 2.8 (Appendix F-2)

It is possible that well seals in adjacent wells could fail due to improper materials in adjacent wellbores, such as cement inside and behind casing, casing and equipment metallurgy, and plugging materials. This event could also occur due to undiscovered orphan wells that create leak paths to the surface due to improper plugging.

Likelihood: Rare

Consequence Severity: Moderate

Prevention and Detection:

- Perform proper corrective action review and design, including appropriate cement and metallurgy of the plugging materials.
- An aeromagnetic survey will be conducted to ensure that no undocumented or unknown wellbores are present.
- Plugging and abandonment operations for applicable artificial penetrations will be designed and executed with CO_2-resistant cement and monitored as described in *Section 5 – Testing and Monitoring Plan*.
- Continuous pressure monitoring at surface and downhole will highlight potential issues.
- Pressure and rate monitoring, pressure falloff tests, annulus pressure tests, etc., will all be performed according to *Section 5*.
- Operate a closely monitored facility and surrounding area.
- Surface CO_2 detection equipment will be installed.

Potential Response Actions:

- Cease injection and notify the UIC Director and other pertinent agencies within 24 hours.
- Close the wellhead valve.
- Monitor well and annulus pressures.
- Determine the cause and severity of failure to determine if the CO_2 stream or formation fluids may have been released into any unauthorized zone.
- Determine if personnel need to be evacuated from the facility and begin gas-monitoring operations.
- Allow pressure to bleed off the equipment and process system and allow atmospheric gas levels to return to normal.
- Perform any well reentry and corrective action as necessary to regain isolation of injectate/formation fluids.
- Demonstrate mechanical integrity per the methods discussed in *Section 5*.
- Resume injection at a reduced rate if possible to do so, with the approval of the UIC Director and the appropriate agency.

8.3.2.7 Specific Event Description – Sabotage/terrorist attack and general security

Risk Assessment Matrix, Section 2.9 (Appendix F-2)

This event could theoretically happen during injection-facility operations by any person or organization wishing to cause harm to life, property, or the environment. This facility itself is not of strategic or cultural importance; therefore, this event has historically been a very low risk. However, given the increasing importance of this region for global energy infrastructure and domestic energy security, the likelihood of this being a target will increase throughout the project life cycle. Titan will have general security measures in place to monitor the injection sites and facilities. This may include, but will not be limited to, fencing, security cameras, gate guards, hired security services, aerial monitoring, etc.

Likelihood: Rare

Consequence Severity: Low

Prevention and Detection:

- Stay current with recent events locally and around the country and globe that could potentially warrant a threat to the facility.
- Properly secure the facility and surrounding area.
- Proper operation and preventive maintenance of all surface-facility equipment will be carried out.
- Surface wellhead tree will be regularly maintained and tested for integrity.
- Subsurface safety valve will be regularly tested.
- Proper surface monitoring will be distributed across the facilities.
- Communication with proper authorities regarding threats to the facility or surrounding energy infrastructure will be scheduled on a regular basis.
- Surface CO_2 detection equipment will be installed.

Potential Response Actions:

- Shut in the flow line at the surface.
- Cease injection and notify the UIC Director and other pertinent agencies within 24 hours.
- Close the wellhead valve.
- Monitor well and annulus pressures.
- Determine if personnel need to be evacuated from the facility and begin gas-monitoring operations.
- Allow pressure to bleed off the equipment and process system and allow atmospheric gas levels to return to normal.
- Determine the cause and severity of the attack in order to initiate repairs.
- Demonstrate mechanical integrity per the methods discussed in *Section 5 – Testing and Monitoring Plan*.
- Resume injection at a reduced rate if possible to do so, with the approval of the UIC Director and the appropriate agency.

8.3.2.8 Specific Event Description – Induced seismicity directly caused by injection, leading to leakage

Risk Assessment Matrix, Section 2.10 (Appendix F-2)

Although highly unlikely, the process of injection could induce a seismic event that causes the plume to reach faults or fractures that allow CO_2 migration to the surface.

Likelihood: Remote

Consequence Severity: Low

Prevention and Detection:

- The CO_2 plume will be monitored as described in *Section 5 – Testing and Monitoring Plan*.
- The chosen project location is both a seismically quiet area and a sufficient distance from nearby shallow faults that could act as a conduit.
- The well is specifically designed, constructed, and operated with components such as CO_2-resistant cement, corrosion-resistant alloy tubulars, and other design factors to reduce the likelihood of a CO_2 leak.
- Surface CO_2 detection equipment will be installed.

Potential Response Actions:

- Cease injection and notify the UIC Director and other pertinent agencies within 24 hours.
- Determine if personnel need to be evacuated from the facility and begin gas-monitoring operations.
- Allow pressure to bleed off the equipment and process system, and allow atmospheric gas levels to return to normal.
- Determine the cause and severity of the failure in order to initiate repairs.
- Use VSP or seismic surveys to assess the location and degree of CO_2 movement, as described in *Section 5*.
- Resume injection at a reduced rate if possible to do so, with the approval of the UIC Director and the appropriate agency.
- Continue monitoring the plume at a more frequent interval to determine if migration continues.
- If the plume continues to migrate out of the zone or beyond the expected plume extent, recomplete uphole into the next planned injection stage.

8.3.2.9 Specific Event Description – Act of God

Risk Assessment Matrix, Section 2.11 (Appendix F-2)

This would likely occur through the impact of a storm or other natural event that impacts the facility or integrity of the injection system.

Likelihood: Remote

Consequence Severity: Low

Prevention and Detection:

- Equipment will be maintained regularly to prevent or minimize damage.
- Damage-prevention infrastructure will be installed and markers placed to alert the public of the potential hazards. The markers will include the operator's name and telephone number.
- Weather will be continuously monitored and, during the possibility of an adverse event, precautions will be taken to limit the potential impact.

Potential Response Actions:

- Cease injection and notify the UIC Director and other pertinent agencies within 24 hours.
- Determine the cause and severity of the failure and initiate repairs.
- Demonstrate mechanical integrity per the methods discussed in *Section 5 – Testing and Monitoring Plan*.
- Resume injection at a reduced rate if possible to do so, with the approval of the UIC Director and the appropriate agency.

8.3.3 Event Category – Entrained Contaminant (Non-CO_2) in Injection Stream

8.3.3.1 Specific Event Description – Change in CO_2 composition/properties from its source

Risk Assessment Matrix, Sections 5.1 and 5.2 (Appendix F-2)

This event could occur due to changes in contamination levels in the CO_2 source. The sources of contaminants may impact dissolution, geochemical reactions, and wellbore integrity. This could have an effect on the reservoir and the metallurgical properties of surface and downhole equipment.

Likelihood: Remote

Consequence Severity: Low

Prevention and Detection:

- Samples of the CO_2 stream will be collected from the injection-source pipeline. The samples will represent injection conditions and be sent to a third-party laboratory for analysis. The analysis will be used to indicate contaminant levels.

Potential Response Actions:

- Cease injection and notify the UIC Director and other pertinent agencies within 24 hours.
- Determine the cause of contaminants.
- Investigate downhole issues.
- Remediate the source of contaminants.
- Chemically treat the stream to reduce the effect of contaminants.
- Replace tubing and packer if necessary.
- Demonstrate mechanical integrity per the methods discussed in *Section 5*.
- Resume injection at a reduced rate if possible to do so, with the approval of the UIC Director and the appropriate agency.

8.3.3.2 Specific Event Description – Microbial activity initiated by injection process or composition, allowing possible production of H_2S

Risk Assessment Matrix, Section 5.3 (Appendix F-2)

This event could occur due to changes in contamination levels in the CO_2 source that allow microbial activity for possible production of H_2S gas. These sources of contaminants may impact dissolution, geochemical reactions, and wellbore integrity.

Likelihood: Remote

Consequence Severity: Low

Prevention and Detection:

- Samples of the CO_2 stream will be collected from the injection-source pipeline. The samples will represent injection conditions and be sent to a third-party laboratory for analysis. The analysis will be used to indicate contaminant levels.

Potential Response Actions:

- Cease injection and notify the UIC Director and other pertinent agencies within 24 hours.
- Determine the cause of contaminants.
- Investigate downhole issues.
- Remediate the source of contaminants.
- Chemically treat the stream to reduce the effect of contaminants.
- Replace tubing and packer if necessary.
- Demonstrate mechanical integrity per the methods discussed in *Section 5 – Testing and Monitoring Plan*.
- Resume injection at a reduced rate if possible to do so, with the approval of the UIC

Director and the appropriate agency.

8.3.4 Event Category – Accidents/Unplanned Events (Typical Insurable Events)

8.3.4.1 Specific Event Description – Surface infrastructure damage
Risk Assessment Matrix, Section 6.1 (Appendix F-2)

Unforeseen events, such as surface infrastructure damage, pipeline leak, compressor failure, boater or animal damage, or weather-related events, may occur while operating Cronos No. 1 and Rhea No. 1.

Likelihood: Remote

Consequence Severity: Low

Prevention and Detection:

- Equipment will be maintained regularly to prevent or minimize damage.
- Damage-prevention infrastructure will be installed, and markers placed to alert the public of the potential hazards. The markers will include the operator's name and telephone number.
- Barricades will be installed to prevent accidental damage to any equipment, and to prevent animals from entering the facility.
- Weather will be continuously monitored, and, during the possibility of an adverse event, precautions will be taken to limit the potential impact.

Potential Response Actions:

- Cease injection and notify the UIC Director and other pertinent agencies within 24 hours.
- Determine the cause and severity of the failure and initiate repairs.
- Demonstrate mechanical integrity per the methods discussed in *Section 5 – Testing and Monitoring Plan*.
- Resume injection at a reduced rate if possible to do so, with the approval of the UIC Director and the appropriate agency.

8.3.4.2 Specific Event Description – Severe weather event
Risk Assessment Matrix, Section 6.2 (Appendix F-2)

Unforeseen weather-related events, such as a hurricane, are likely to occur while operating Cronos No. 1 and Rhea No. 1.

Likelihood: Almost Certain

Consequence Severity: Moderate

Prevention and Detection:

- Equipment will be maintained regularly to prevent or minimize damage.
- Damage-prevention infrastructure will be installed, and markers placed to alert the public of the potential hazards. The markers will include the operator's name and telephone number.
- Weather will be continuously monitored and, during the possibility of an adverse event, precautions will be taken to limit the potential impact.

Potential Response Actions:

- Cease injection and notify the UIC Director and other pertinent agencies within 24 hours.
- Determine the cause and severity of the failure and initiate repairs.
- Demonstrate mechanical integrity per the methods discussed in *Section 5*.
- Resume injection at a reduced rate if possible to do so, with the approval of the UIC Director and the appropriate agency.

Tables 8-1 to 8-3 outline the risk assessment process discussed above.

8.4 Risk Activity Matrix

Table 8-1 – Risk Activity Matrix

Table 8-2 – Risk Mitigation and Threat Scores

THREAT SCORES	RISK MITIGATION
≥15	Avoid. Mitigate through immediate responsive action to reduce likelihood to an acceptable level.
10.0-14.9	Preventive and mitigative (P&M) measures required.
3.5-9.9	P&M measures are optional. Monitoring required.
0-3.4	No P&M measures are required. Monitor situation.

Table 8-3 – Risk Assessment Scores

Risk Assessment Scores						
Likelihood	5 Imminent	5	10	15	20	25
	4 Likely	4	8	12	16	20
	3 Occasional	3	6	9	12	15
	2 Rare	2	4	6	8	10
	1 Remote	1	2	3	4	5
		Very Low 1	Low 2	Moderate 3	High 4	Very High 5
		Severity				

8.5 Training

Personnel will be trained in their duties and responsibilities related to these facilities during annual on-site or tabletop training exercises. All plant personnel, visitors, and contractors must attend a plant risk orientation before entering any of the facilities. A refresher course on this training is required annually for all personnel according to hurricane response training.

Titan will provide a copy of the ERRP to local first responders that includes potential response scenarios, 24-hour facility contacts, the location of the wells, and schematics/diagrams of the facilities and wells. Titan will also perform internal screening on all site personnel, including third-party contractors, to ensure safety performance and that insurance requirements are met.

8.6 Communications Plan and Emergency Notification Procedures

Prior to commencing injection operations, a site-specific emergency response plan will be developed and implemented. This plan will specify the Incident Command center, muster points, and person-in-charge for any events that might occur. Emergency response numbers are provided in Tables 8-4 through 8-6.

Table 8-4 – Emergency Services – CALL 911

Agency	Telephone Number
Port Arthur and Sabine Pass Fire Department	911 or 409-983-8740
Jefferson County Sheriff	911 or 409-835-8411
Port Arthur Police Department	911 or 409-983-8600
Jefferson County Health Unit #2 (Port Arthur)	409-983-8380
Jefferson County Emergency Preparedness Office	409-835-8757
Texas Department of Public Safety	409-924-5466
Texas Fish and Wildlife Service	512-353-0011

Table 8-5 – Government Agency Notification

Agency	Telephone Number
EPA Region 6	214-665-2102
Class VI Contact	214-665-7252
Texas Commission on Environmental Quality	512-239-6075
Texas Railroad Commission	512-463-3011
National Response Center (NRC)	800-424-8802
Texas General Land Office – Coastal Resources	512-475-0773

Table 8-6 – Internal Call List

Name	Title	Telephone Number
[redacted]		

As appropriate, Titan will communicate with the public and affected surface owners regarding events that require an emergency response—including the impact of the event on drinking water or the severity of the event, actions taken or planned to address the event, and other information needed to protect the public during the event.

8.7 Flood Hazard Risk

Due to their location near the coast, the Cronos No. 1 and Rhea No. 1 injection wells and surrounding area are designated as a mixture of FEMA flood hazard zones. Flood hazard zone "V19" corresponds to the surface locations and a coastal area within a 1% annual chance flood event, with additional hazards due to storm-induced, velocity-wave action. Both zones are

subject to a 26% chance of flooding over a 30-year life span. Floodplain management standards apply. The well locations and FEMA flood zones are shown in *Appendix F-3*.

8.8 Emergency and Remedial Response Plan Review and Updates

This ERRP will be reviewed and updated annually. Any amendments to the plan must be approved by the UIC Director and will be incorporated into the permit:

- Within one year of an AOR evaluation
- Following any significant changes to the facility, such as the addition of injection or monitoring wells
- After a change in key personnel
- As required by the UIC Director

The following attachments are in *Appendix F*:

- Appendix F-1 Resources and Infrastructure in AOR Map
- Appendix F-2 Complete Risk Assessment Matrix
- Appendix F-3 FEMA Flood Zone Hazards Map
- Appendix F-4 Emergency Operations Plan