SECTION 8 – EMERGENCY AND REMEDIAL RESPONSE PLAN

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Figures

None included.

Tables

8.1 Introduction

This Emergency and Remedial Response plan for the subject injection well, WC IW-A No. 001, was prepared to meet the requirements of Statewide Order (SWO) 29-N-6, **§623** [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 plan to be updated immediately.

8.2 Resources/Infrastructure in AOR

[redacted] The proposed location is approximately [redacted] miles from the nearest freshwater drinking water well. No dwellings are located within the currently predicted area of review (AOR), and no artificial penetrations lie there within. Structures within the AOR are located on the leased acreage and are used for recreational purposes, such as hunting. Additionally, as shown in *Appendix C-6*, no state or federal subsurface cleanup sites, subsurface mines, or quarries are located within the currently predicted AOR.

The well and the currently predicted carbon front are located on and below what is primarily wooded wetlands. A portion of the carbon front extent is located in the subsurface below rural farmland. The well location will be accessible through new roads to be constructed in the wooded wetlands. *Appendix G-3* shows roads, pipelines, and other infrastructure in the area as well as the well location and carbon front extent.

The lowermost Underground Source of Drinking Water (USDW) in the AOR is estimated to be found at approximately [redacted].

8.3 Resources/Infrastructure – Specific Events and Response Plans

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

8.3.1 Event Category – CO_2 Release to or at the Surface

8.3.1.1 Specific Event Description – Overpressurization (i.e., induced) and/or major mechanical failure of facility equipment or flowlines on the injection well pad
Risk Assessment Matrix, Section 1.1 (Appendix G-1)

This event could happen during operations of the injection facility by operating equipment outside of designed pressures or outside of compositional limits, beyond recommended preventative maintenance (PM) cycles, or, otherwise, improperly. This could also occur if the maximum allowable

operating parameters change due to depreciation or corrosion of equipment and are not accounted for.

Likelihood: [redacted]

Prevention and Detection

- Proper operation and PM of all facility equipment on the injection well pad will be carried out.
- The facility will be closely monitored with system controls in place to prevent overpressure and release.
- Tubing and annular pressures will be monitored and maintained below the maximum allowed values.
- The surface wellhead tree will be regularly maintained and tested for integrity.
- Safety systems will have automatic shut-in capabilities.
- CO_2 detectors will be utilized to continuously monitor ambient air.

Potential Response Actions

- Stop the injection and notify the Underground Injection Control (UIC) Program Director (UIC Director) within 24 hours.
- Shut in the flow line (source) upon any detection of CO_2 at the surface.
- Set plug in near-surface nipple as secondary barrier to flow.
- Close the applicable wellhead valve(s).
- 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, if feasible, prior to resuming injection operations.
- Demonstrate mechanical integrity per the methods discussed in *Section 5 – Testing and Monitoring Plan*.
- Notify the UIC Director when injection can be expected to resume.

8.3.1.2 Specific Event Description – Caprock/reservoir failure (e.g., carbon front migrates along fault line/fissure to surface)

Risk Assessment Matrix, Section 1.2 (Appendix G-1)

This event could occur due to unforeseen geological complications.

Likelihood: [redacted]

Prevention and Detection

- Well has been located to avoid faults of concern and verified via 3D seismic survey.
- Confinement has been demonstrated through dynamic geocellular modeling efforts.
- Pressure and rate monitoring, pressure falloff tests, etc., will all be performed according to *Section 5*.
- Tubing and annular pressures will be monitored and maintained below the maximum allowed values.
- CO_2 detectors will be utilized to continuously monitor ambient air.

Potential Response Actions

- Stop the injection and notify the UIC Director within 24 hours.
- Shut in the flow line (source) upon any detection of CO_2 at the surface.
- Close the applicable wellhead valve(s).
- Monitor well and annulus pressures.
- Continue carbon front monitoring at a more frequent interval to determine if migration continues.
- If the carbon front continues to migrate out of the zone or beyond the expected carbon front extent, recomplete uphole into the next planned injection interval.
- 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, if feasible, prior to resuming injection operations.
- Recomplete well to a new injection interval to avoid permanent reservoir damage.
- Demonstrate mechanical integrity per the methods discussed in *Section 5 – Testing and Monitoring Plan*.
- Notify the UIC Director when injection can be expected to resume.

8.3.1.3 Specific Event Description – Poor cement job can allow for CO_2 to escape near wellbore
Risk Assessment Matrix, Section 1.3 (Appendix G-1)

This event could occur due to an inadequate cement selection or design.

Likelihood: [redacted]

Prevention and Detection

- Proper wellbore design, including proper premium CO_2 cement, will be implemented in the well construction phase.
- A cement-bond logging tool will be used to check the quality of the cementing job, to ensure the job was successful.
- Routine temperature and casing inspection logs will be performed.
- CO_2 detectors will be utilized to continuously monitor ambient air.

Potential Response Actions

- Stop the injection and notify the UIC Director within 24 hours.
- Shut in the flow line (source) upon any detection of CO_2 at the surface.
- Close the applicable wellhead valve(s).
- 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, if feasible, prior to resuming injection operations. Demonstrate mechanical integrity per the methods discussed in *Section 5 – Testing and Monitoring Plan*.
- Notify the UIC Director when injection can be expected to resume.

8.3.1.4 Specific Event Description – Casing or wellhead failure/leak
Risk Assessment Matrix, Section 1.4 (Appendix G-1)

This event could occur due to the corrosive nature of the injection fluid.

Likelihood: [redacted]

Prevention and Detection

- Proper wellbore design, including proper metallurgy of the casing and tubing, will be implemented in the construction phase.
- Ongoing monitoring and mechanical integrity testing will confirm integrity.
- Perform routine wellhead and casing inspection.
- Perform quality assurance/quality control (QA/QC) per American Petroleum Institute (API) standards.
- Utilize CO_2 detectors to continuously monitor ambient air.

Potential Response Actions

- Stop the injection and notify the UIC Director within 24 hours.
- Shut in the flow line (source) upon any detection of CO_2 at the surface.

- Set plug in near-surface nipple as secondary barrier to flow.
- Close the applicable wellhead valve(s).
- 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, if feasible, prior to resuming injection operations. Demonstrate mechanical integrity per the methods discussed in *Section 5 – Testing and Monitoring Plan*.
- Notify the UIC Director when injection can be expected to resume.

8.3.1.5 Specific Event Description – Well seal failure of adjacent well(s) (e.g., plugging and abandonment (P&A) wells, monitor wells)
Risk Assessment Matrix, Section 1.5 (Appendix G-1)

This event could occur due to the corrosive nature of the CO_2 stream and failure of the use of proper materials in adjacent wellbores, such as cement inside and behind casing, casing and equipment metallurgy, and plugging materials.

Likelihood: [redacted]

Prevention and Detection

- Corrective action will include detailed review and design, including appropriate cement and metallurgy of the plugging materials.
- Continuous pressure monitoring at surface and downhole will highlight potential issues.
- Pressure and rate monitoring, pressure falloff tests, etc., will all be performed according to *Section 5*.
- The facility and surrounding area will be closely monitored, with competent management of operations.

Potential Response Actions

- Stop the injection and notify the UIC Director within 24 hours.
- Close the applicable wellhead valve(s).
- Monitor well and annulus pressures.
- Determine if personnel need to be evacuated from the facility and begin gas monitoring operations.
- Determine the cause and severity of the failure, to determine if any of the CO_2 stream or formation fluids may have been released into any unauthorized zone.
- Pull and replace the tubing or the packer (in adjacent well), if necessary.
- Install a chemical sealant barrier and/or attempt a cement squeeze to block leaks in the

offset wellbore.
- Demonstrate mechanical integrity per the methods discussed in *Section 5*.
- Notify the UIC Director when injection can be expected to resume.

8.3.1.6 Specific Event Description – Orphan well failure (e.g., well not identified prior to injection)
Risk Assessment Matrix, Section 1.6 (Appendix G-1)

This event could occur due to orphan wells that are not known to exist. These wells could create leak paths to the surface due to improper plugging and/or lack of proper materials, such as cement inside and behind casing, casing and equipment metallurgy, and plugging materials.

Likelihood: [redacted]

Prevention and Detection

- An exhaustive well-records search will be performed to identify all wellbores in the AOR.
- Magnetic surveying could be performed to potentially find undocumented/unknown wellbores.
- Corrective action will include detailed review and design, including appropriate cement and metallurgy of the plugging materials.
- Continuous pressure monitoring at surface and downhole will highlight potential issues.
- Pressure and rate monitoring, pressure falloff tests, etc., will all be performed according to *Section 5*.
- The facility and surrounding area will be closely monitored, with competent management of operations.

Potential Response Actions

- Stop the injection and notify the UIC Director within 24 hours.
- Close the applicable wellhead valve(s).
- Monitor well and annulus pressures.
- Determine the cause and severity of the failure, to determine if any of 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 – Testing and Monitoring Plan*.
- Notify the UIC Director when injection can be expected to resume.

8.3.1.7 Specific Event Description – Sabotage/terrorist attack

Risk Assessment Matrix, Section 1.7 (Appendix G-1)

This event could happen during operations of the injection facility by any person or organization wishing to cause harm to life, property, or environment. This facility is not of strategic or cultural importance; therefore, this has a very low risk.

Likelihood: [redacted]

Prevention and Detection

- Stay up to date with current events in the local area and country and around the world that could potentially warrant a threat to the facility.
- Maintain proper security of the facility and surrounding area.
- Carry out proper operation and PM of all surface facility equipment.
- Maintain the surface wellhead tree regularly and test for integrity.

Potential Response Actions

- Stop the injection and notify the UIC Director within 24 hours.
- Shut in the flow line (source) upon any detection of CO_2 at the surface.
- Set plug in near-surface nipple as secondary barrier to flow.
- Close the applicable wellhead valve(s).
- 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, if feasible, prior to resuming injection operations.
- Demonstrate mechanical integrity per the methods discussed in *Section 5 – Testing and Monitoring Plan*.
- Notify the UIC Director when injection can be expected to resume.

8.3.1.8 Specific Event Description – Induced seismicity directly caused by injection, resulting in leakage

Risk Assessment Matrix, Section 1.8 (Appendix G-1)

This event could occur if the process of injection builds up reservoir pressure, to the point that it induces a seismic event that causes the carbon front to reach faults or fractures that allow CO_2 migration to the surface.

Likelihood: [redacted]

Prevention and Detection

- Pressure, rate, and carbon front monitoring, pressure falloff tests, etc., will all be performed according to *Section 5*.
- During active injection, pressure will be continuously monitored to ensure bottomhole pressure remains below 90% frac gradient.
- The chosen project location is a seismically quiet area and a sufficient distance from nearby shallow faults that could act as a conduit.
- Known faults have been assessed and modeled appropriately, and with low seismic risk in the area, this event is not likely.
- Fault-slip potential analysis (refer to *Appendix I*) does not indicate induced seismicity potential.
- Geomechanical modeling to be completed as needed to optimize injection program.
- Secondary/tertiary seals are present above the primary upper confinement.
- The well and operating strategy are designed to prevent the likelihood of this occurring.

Potential Response Actions

- Stop the injection and notify the UIC Director within 24 hours.
- Close the wellhead valve(s), if applicable.
- Monitor well and annulus pressures.
- Use seismic surveys to assess the location and degree of CO_2 movement, as described in *Section 5*.
- Continue carbon front monitoring at a more frequent interval to determine if migration continues.
- If the carbon front continues to migrate out of the zone or beyond the expected carbon front extent, recomplete uphole into the next planned injection interval.
- 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 determine if any of the CO_2 stream or formation fluids may have been released into any unauthorized zone and to initiate repairs, if feasible.
- Demonstrate mechanical integrity per the methods discussed in *Section 5*.
- Notify the UIC Director when injection can be expected to resume.

8.3.1.9 Specific Event Description – Act of God (force majeure)

Risk Assessment Matrix, Section 1.9 (Appendix G-1)

This event could occur when the surface structures are impacted by major storms or wildfire, or their equivalent.

Likelihood: [redacted]

Prevention and Detection

- Proper operation and PM of all surface facility equipment will be carried out.
- The surface wellhead tree will be regularly maintained and tested for integrity.
- Safety systems will have automatic shut-in capabilities.
- Surface equipment will be designed to withstand storms.
- Company policy ensures that operations are shut in during possible events.

Potential Response Actions

- Stop the injection and notify the UIC Director within 24 hours.
- Set plug in near-surface nipple as secondary barrier to flow.
- Close the applicable wellhead valve(s).
- 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 any potential failures, to initiate repairs, if feasible, prior to resuming injection operations.
- Demonstrate mechanical integrity per the methods discussed in *Section 5 – Testing and Monitoring Plan*.
- Notify the UIC Director when injection can be expected to resume.

8.3.2 Event Category – Water Quality Contamination

8.3.2.1 Specific Event Description – Leakage of CO_2 or other dissolved contaminant outside permitted area into freshwater aquifer

Risk Assessment Matrix, Sections 2.1 & 2.3 (Appendix G-1)

Water quality contamination could happen during operations of the carbon storage facility. Contamination could occur if the carbon front reaches faults, fractures, or artificial penetrations that allow CO_2 migration into another zone—including the USDW—or to the surface. Failure of the confining zone and the wellbore's integrity could also cause CO_2 or other dissolved contaminants from the injection formation to migrate and contaminate the USDW. In general, many events that are discussed in *Section 8.3.1* could lead to water quality contamination.

Likelihood: [redacted]

Prevention and Detection

- The carbon front will be closely monitored with time lapse seismic surveys as described in *Section 5*.
- The wellbore is designed with premium materials and for long-term integrity to prevent the likelihood of this event occurring.
- Wellbore integrity will be monitored, tested, and verified as described in *Section 5 – Testing and Monitoring Plan*.
- The chosen project location is a seismically quiet area and a sufficient distance from nearby shallow faults that could act as a conduit.
- Fault-slip potential analysis does not indicate induced seismicity potential.
- Geomechanical modeling will be completed as needed to optimize the injection program.
- Secondary/tertiary seals are present above the primary upper confinement.
- The well and operating strategy are designed to prevent the likelihood of this event occurring.
- Continuous monitoring of injection rate, pressure, and temperature downhole provide additional insight into wellbore integrity.
- Carbon and critical pressure front models will be periodically updated to make sure no artificial penetrations create a leakage path—and, if one is found, the wells will be corrected.

Potential Response Actions

- Reduce injection rates or cease injection and notify the UIC Director within 24 hours.
- Determine the cause and severity of the failure, to determine if any of the CO_2 stream or formation fluids may have been released into any unauthorized zone.
- Investigate downhole issues.
- Use seismic surveys to assess carbon front migration, as described in *Section 5*.
- Continue monitoring the carbon front at a more frequent survey interval to determine if migration continues.
- If groundwater/USDW is negatively impacted, then:
    - Pump CO_2-contaminated groundwater to the surface and aerate it to remove carbon dioxide to acceptable levels.
    - Apply “pump and treat” methods to remove trace elements, if necessary.
    - Drill wells that intersect the accumulations in groundwater, and extract carbon dioxide to acceptable levels.
    - Provide an alternative water supply if groundwater-based public water supplies are contaminated.
- If surface water is impacted, then:
    - Verify through water analysis that dissolved CO_2 is being quickly released back into the atmosphere.
    - Create a hydraulic barrier by increasing the reservoir pressure upstream of the leak.
- If the carbon front continues to migrate out of the zone or beyond the expected carbon front extent, recomplete uphole into the next planned injection interval.
- Demonstrate mechanical integrity per the methods discussed in *Section 5.*
- Notify the UIC Director when injection can be expected to resume.

8.3.2.2 Specific Event Description – Leakage of drilling fluid contaminates potable water aquifer
Risk Assessment Matrix, Section 2.2 (Appendix G-1)

This event could happen during the drilling of the injection well and would be a short-term event in the project life cycle. Drilling fluid may contaminate the potable water aquifer.

Likelihood: [redacted]

Prevention and Detection

- Select a proper drilling-fluids program including fresh-water-based muds while drilling the surface hole interval.
- Drilling mud will be conditioned to prevent losses to the formation.
- All USDWs will be isolated with casing and cement per regulations.
- Industry best practices will minimize the probability of this incident.
- The injection well is designed to prevent the likelihood of this occurring.

Potential Response Actions

- Investigate downhole issues.
- Drilling mud will be conditioned to prevent losses to the formation.
- If the groundwater/USDW is negatively impacted, then:
    - 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 contaminated.

8.3.3 Event Category – Storage Rights Infringement (i.e., Mineral Rights Infringement)

8.3.3.1 Specific Event Description – Carbon front migrates into adjacent pore space
Risk Assessment Matrix, Section 3.1 (Appendix G-1)

This event could occur if the carbon front expands beyond what the reservoir model predicts—and migrates off controlled acreage, into neighboring pore space not controlled by the operator.

Likelihood: [redacted]

Prevention and Detection

- The carbon front will be monitored as described in *Section 5 – Testing and Monitoring Plan*, to reduce the likelihood that the carbon front exceeds the controlled pore-space boundary.
- Control of pore space will be obtained through outright ownership or lease agreements.

Potential Response Actions

- Notify the UIC Director within 24 hours.
- Use seismic surveys to assess the location and degree of CO_2 movement, as described in *Section 5*.
- Possibly recomplete into a new, shallower injection interval to control maximum carbon front extent.
- Continue carbon front monitoring at a more frequent interval to determine if migration continues.
- If trespass is detected or identified to be likely, then:
    - Begin negotiations with the neighboring landowner to acquire rights to store within adjacent pore spaces.
- If infringement is detected or identified to be likely, then:
    - Obtain control of additional pore space through outright ownership or lease agreements, to maintain total project-storage potential.
- Notify the UIC Director when injection can be expected to resume.

8.3.3.2 Specific Event description – Infringement on White Castle storage space by others/competitors

Risk Assessment Matrix, Section 3.2 (Appendix G-1)

This event could occur if the pore space controlled by the operator is infringed upon by others or competitors. The probability of this event is low, this project being the first to exist in this location; the adjoining acreage has limited project-development capabilities.

Likelihood: [redacted]

Prevention and Detection

- The carbon front will be monitored as described in *Section 5*.
- Strategically locate the injection operations in an area devoid of other carbon sequestration or injection operations.

Potential Response Actions

- Reduce injection rates or cease injection, if needed, and notify the UIC Director within 24 hours.
- Use seismic surveys to assess location and degree of CO_2 movement, as described in *Section 5 – Testing and Monitoring Plan*.
- Possibly recomplete into a new, shallower injection interval to control maximum carbon front extent.
- Continue carbon front monitoring at a more frequent interval to determine if migration continues.

- Notify the UIC Director when injection can be expected to resume.

8.3.3.3 Specific Event description – Acts of God affecting storage capacity of pore space (force majeure)
Risk Assessment Matrix, Section 3.3 (Appendix G-1)

This event could occur if a major natural event impacts the subsurface.

Likelihood: [redacted]

Prevention and Detection

- Known faults have been assessed and modeled appropriately, and with low seismic risk in the area, this event is not likely.
- Wildfire or a major storm is more likely, which would impact surface—not pore space.
- Safety systems will have automatic shut-in capabilities.

Potential Response Actions

- Stop the injection and notify the UIC Director within 24 hours.
- Close the applicable wellhead valve(s).
- Monitor well and annulus pressures.
- Possibly recomplete into a new, shallower injection interval to control maximum carbon front extent.
- Notify the UIC Director when injection can be expected to resume.

8.3.4 Event Category – Mineral Rights Infringement (Trespass)

8.3.4.1 Specific Event Description – Carbon front migrates into mineral zone or hydraulic front impacts recoverable mineral zone
Risk Assessment Matrix, Section 4.1 (Appendix G-1)

This event could occur if the carbon front expands beyond what the reservoir model predicts, migrates off controlled acreage into neighboring pore space not controlled by the operator—and affects economic production of mineral resources from that area.

Likelihood: [redacted]

Prevention and Detection

- Strategically locate the injection operations in an area devoid of hydrocarbon resources.
- The carbon front will be monitored as described in *Section 5 – Testing and Monitoring Plan*.
- Obtain control of pore space through outright ownership or lease agreements.

Potential Response Actions

- Reduce injection rates or cease injection and notify the UIC Director within 24 hours.
- Use seismic surveys to assess location and degree of CO_2 movement, as described in *Section 5*.
- Possibly recomplete into a new, shallower injection interval to control maximum carbon front extent.
- Continue carbon front monitoring at a more frequent interval to determine if migration continues.
- If trespass is detected or identified to be likely, then:
    - Begin negotiations with the neighboring landowner to acquire rights to store within adjacent pore spaces.
- If hydrocarbon resource infringements are detected or identified to be likely, then:
    - Begin negotiations with mineral owners to determine the impact of the infringement.

8.3.4.2 Specific Event Description – Discovery of recoverable minerals below the injection interval or enabled recovery of previously uneconomically recoverable minerals

Risk Assessment Matrix, Sections 4.2 & 4.3 (Appendix G-1)

This event could occur if there is a post-injection discovery of recoverable minerals below the injection interval—thereby creating a higher cost for future discovery and potential litigation—and/or if previously uneconomically recoverable minerals become economically feasible.

Likelihood: [redacted]

Prevention and Detection

- The carbon front will be monitored as described in *Section 5*.
- Control of pore space will be obtained through outright ownership or lease agreements.
- Injection operations will be strategically located in an area devoid of hydrocarbon resources.
- Multiple dry holes drilled in the area demonstrate a general lack of recoverable hydrocarbon resources in the immediate vicinity.

Potential Response Actions

- If hydrocarbon resource infringements are detected or identified to be likely below the injection interval, begin negotiations with mineral owners to determine the impact of the infringement.

8.3.4.3 Specific Event Description – Seismic event or other Act of God occurs in project area

Risk Assessment Matrix, Section 4.4 (Appendix G-1)

This event could occur if the carbon front reaches faults or fractures that allow CO_2 migration into another zone. Failure of the confining zone could also cause CO_2 to migrate and impact future

mineral production. It is unlikely that productive minerals exist above the injection interval, given the lack of historical production in this area.

Likelihood: [redacted]

Prevention and Detection

- The carbon front will be monitored as described in *Section 5 – Testing and Monitoring Plan*.
- The chosen project location is a seismically quiet area and a sufficient distance from nearby shallow faults that could act as a conduit.
- Fault-slip potential analysis (refer to *Appendix H*) does not indicate induced seismicity potential.
- Geomechanical modeling to be completed as needed to optimize the injection program.
- The well and operating strategy are designed to prevent the likelihood of this event occurring.

Potential Response Actions

- If hydrocarbon resource infringements are detected or identified to be likely, begin negotiations with mineral owners to determine the impact of the infringement.

8.3.4.4 Specific Event Description – Formation fluid interaction due to CO_2 injection
Risk Assessment Matrix, Section 4.5 (Appendix G-1)

This event is expected to happen. Chemical compatibility studies indicate that this will happen, with no adverse effects. In fact, this chemical interaction is desired.

Likelihood: [redacted]

Prevention and Detection

- No prevention necessary.

Potential Response Actions

- The saline aquifer is not usable as a freshwater source. No detrimental impacts are expected. Chemical interaction is desired to lock CO_2 in place.

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

8.3.5.1 Specific Event Description – Change in CO_2 composition/properties from its source impacts the storage reservoir
Risk Assessment Matrix, Section 5.1 (Appendix G-1)

This event could occur due to unexpected changes in contamination levels in the CO_2 stream outside of what the project has been designed to receive. The sources of contaminants may impact dissolution and geochemical reactions.

Likelihood: [redacted]

Prevention and Detection

- Based on the pipeline composition specifications (see Table 4-2 in *Section 4 – Engineering Design and Operating Strategy*), geochemical considerations have been, and will continue to be, evaluated as additional data is gathered on the gas stream and storage reservoir.
- Samples of the CO_2 stream will be collected from the injection source pipeline. Representing injection conditions, the samples will be sent to a third-party laboratory for analysis, which will be used to indicate contaminant levels.

Potential Response Actions

- Reduce injection rates or cease injection and notify the UIC Director within 24 hours.
- Determine the cause of contaminants.
- Investigate downhole issues.
- Investigate potential reservoir impacts from contaminants.
- Remediate the source of contaminants.
- Chemically treat the stream to reduce the effect of contaminants.
- Notify the UIC Director when injection can be expected to resume.

8.3.5.2 Specific Event Description – Change in CO_2 composition/properties from its source impacts metallurgical considerations

Risk Assessment Matrix, Section 5.2 (Appendix G-1)

This event could occur due to unexpected changes in contamination levels in the CO_2 stream outside of what the project has been designed to receive. The sources of contaminants may impact the wellbore integrity of all penetrations in the injection interval.

Likelihood: [redacted]

Prevention and Detection

- Based on the pipeline composition specifications (see Table 4-2 in *Section 4*), metallurgical analysis (*Appendix E*) has, and will continue to, inform engineering design as additional data is gathered on the gas stream and storage reservoir.
- Samples of the CO_2 stream will be collected from the injection source pipeline. Representing injection conditions, the samples will be sent to a third-party laboratory for analysis, which will be used to indicate contaminant levels.

Potential Response Actions

- Reduce injection rates or cease injection and notify the UIC Director 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.
- Pull and replace tubing and packer if necessary.
- Assess the risk of contaminant creating metallurgical incompatibilities.
- Demonstrate mechanical integrity per the methods discussed in *Section 5 – Testing and Monitoring Plan*.
- Notify the UIC Director when injection can be expected to resume.

8.3.5.3 Specific Event Description – Microbial activity initiated by injection process or composition allowing possible production of H_2S gas in the subsurface, impacting dissolution and geochemical reactions

Risk Assessment Matrix, Section 5.3 (Appendix G-1)

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

Likelihood: [redacted]

Prevention and Detection

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

Potential Response Actions

- Reduce injection rates or cease injection and notify the UIC Director 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.
- Pull and replace tubing and packer if necessary.
- Assess the risk of contaminant creating metallurgical incompatibilities.
- Demonstrate mechanical integrity per the methods discussed in *Section 5*.
- Notify the UIC Director when injection can be expected to resume.

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

8.3.6.1 Specific Event Description – Accidental surface infrastructure damage (wellhead or flowlines)
Risk Assessment Matrix, Section 6.1 (Appendix G-1)

Unforeseen events such as surface infrastructure damage, pipeline leak, compressor failure, human accident-related or animal damage, or weather-related events, may occur while operating the White Castle Project.

Likelihood: [redacted]

Prevention and Detection

- Equipment will be maintained regularly to prevent or minimize damage.
- Damage-prevention infrastructure will be installed, and markers will be placed to alert the general public of the potential hazards. The markers will include the name of the operator and telephone number.
- Barricades will be installed to prevent accidental damage to any equipment, and to prevent animals from entering the facility and well sites.
- Monitoring and safety equipment in place would minimize the likelihood and impact of such events.
- Continuous and redundant surface-equipment controls will prevent overpressure.
- Safety systems will have automatic shut-in capabilities.

Potential Response Actions

- Stop the injection and notify the UIC Director within 24 hours.
- Shut in the flow line (source) upon any detection of CO_2 at the surface.
- Set plug in near-surface nipple as secondary barrier to flow, if necessary.
- 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*.
- Notify the UIC Director when injection can be expected to resume.

8.3.6.2 Specific Event Description – Hurricane
Risk Assessment Matrix, Section 6.2 (Appendix G-1)

Unforeseen weather-related events (e.g., hurricane) are likely to occur while operating the White Castle Project.

Likelihood: [redacted]

Prevention and Detection

- Equipment will be maintained regularly to prevent or minimize damage.
- Damage-prevention infrastructure will be installed, and markers will be placed to alert the general public of the potential hazards. The markers will include the name of the operator and telephone number.
- Weather will be continuously monitored, and during the possibility of an adverse event, precautions taken to limit the potential impact if one should occur.
- Surface equipment, facilities, and buildings will be designed to withstand storms.
- Company policy ensures that operations will be shut in during possible events.

Potential Response Actions

- Stop the injection and notify the UIC Director within 24 hours.
- Shut in the flow line (source) upon any detection of CO_2 at the surface.
- Set plug in near-surface nipple as secondary barrier to flow, if necessary.
- Determine the cause and severity of the failure, to initiate repairs.
- Demonstrate mechanical integrity per the methods discussed in *Section 5*.
- Notify the UIC Director when injection can be expected to resume.

The following tables and figures outline the risk assessment process discussed above.

8.4 Risk Assessment Metrics

Table 8-1 – Risk Likelihood Metrics

Likelihood	Description
[redacted]	

Table 8-2 – Risk Severity Metrics

Impact / Severity	Financial Impact	Health & Safety	Natural Environment
[redacted]			

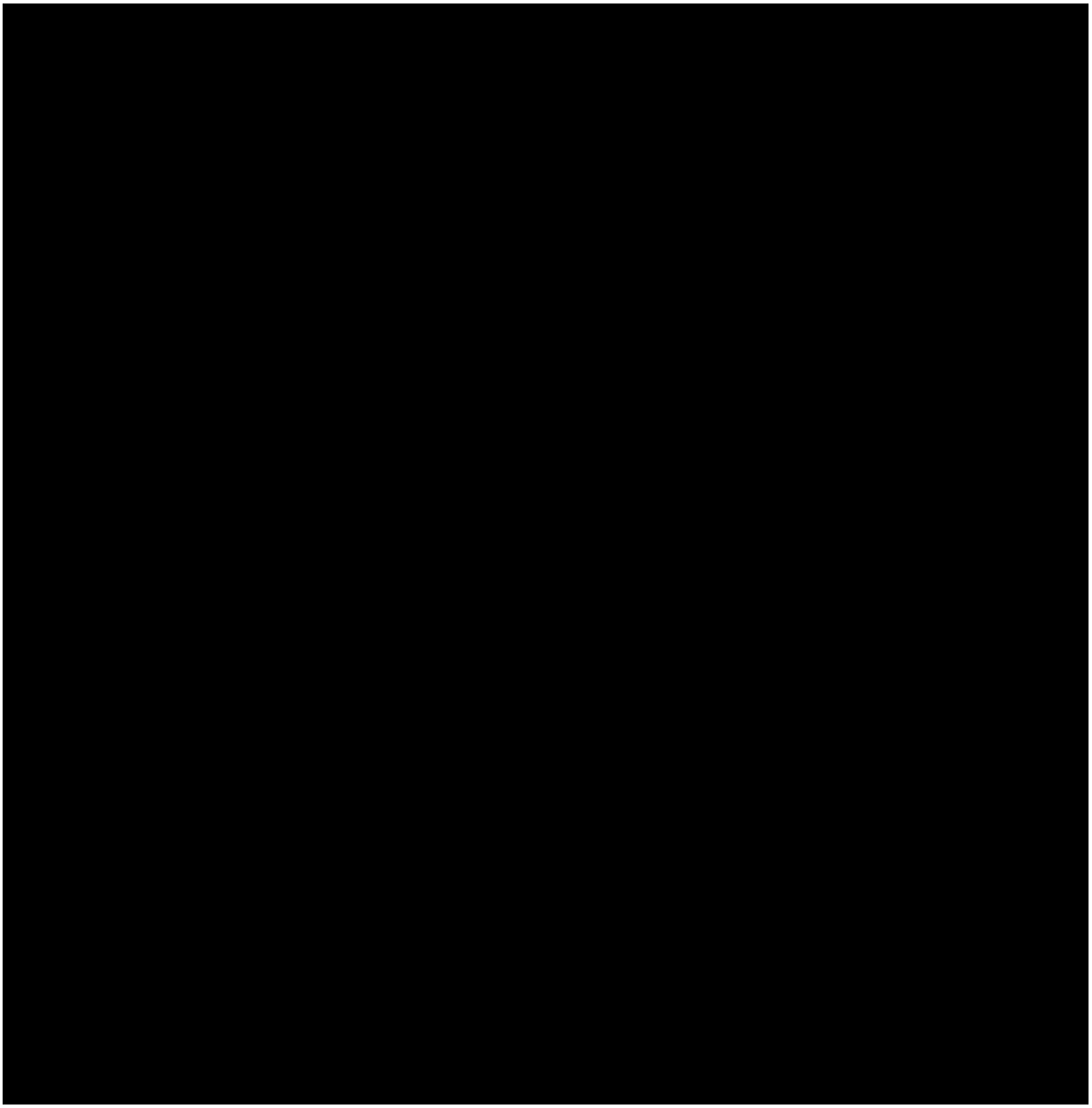
8.5 Risk Activity Matrix

Table 8-3 – Risk Assessment Matrix

Section	Risk (Feature, Event, or Process)	Likelihood	Severity				
			Safety	Environmental	Financial		
		[redacted]		[redacted]		[redacted]	
		1 – Remote, 5 – Almost Certain	1 – Very Low, 5 – Very High				
		Assigned	Assigned	Assigned	Assigned	Estimated Costs	Total Score
1	**CO_2 Release to or at the Surface**	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
2	**Water Quality Contamination**	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
3	**Storage Rights Infringement – Form of Mineral Rights Infringement**	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
4	**Mineral Rights Infringement (Trespass)**	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
5	**Entrained Contaminant (Non-CO_2) in Injection Stream**	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
6	**Accidents/Unplanned Events (Typical Insurable Events)**	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
	Total					[redacted]	

Table 8-4 – Risk Mitigation and Threat Scores

Table 8-5 – Risk Assessment Scores



8.6 Training

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

Prior to first injection, Harvest Bend CCS LLC (Harvest Bend CCS) will provide to local first responders and the UIC Director a copy of the Emergency and Remedial Response Plan that includes potential

response scenarios and contact information for internal safety and emergency personnel.

8.7 Communications Plan and Emergency Notification Procedures:

Emergency response contacts:

Table 8-6 – Emergency Services – **CALL 911**

Agency	Telephone Number
White Castle Fire Department	911 or (225) 545-9214
Iberville Parish Sheriff	911 or (225) 687-5100
Iberville Parish Health Unit	(225) 687-9021
Iberville Parish Office of Emergency Preparedness	(225) 687-5140
Louisiana Emergency Preparedness Office	(225) 763-3535
Louisiana State Police	(504) 310-7000
Louisiana State Police – Hazardous Material Hotline	(877) 925-6595

Table 8-7 – Government Agency Notification

Agency	Telephone Number
Environmental Protection Agency Region 6	(214) 665-2200
Class VI Contact	(214) 665-8473
Louisiana Department of Natural Resources	(225) 342-5515
Injection Well Incidents	(225) 342-5515
Iberville-Community Awareness Emergency Response (I-CAER) Committee	(225) 687-5140
National Response Center (NRC)	(800) 424-8802
Louisiana State Police – Hazardous Material Hotline	(877) 925-6595

8.8 Flood Hazard Risk

Though the White Castle Project falls within a wooded wetlands environment, none of the project area falls within a Federal Emergency Management Agency (FEMA) Flood Hazard Zone, thus the flood hazard risk for the White Castle Project is low. The well location and FEMA Flood Hazard Zones are shown in *Appendix G-2*.

8.9 Emergency and Remedial Response Plan Review and Updates

This Emergency and Remedial Response Plan will be reviewed and updated at least once every 5 years. Any amendments to the plan must be approved by the UIC Director and will be incorporated into the permit

- within 1 year of an AOR evaluation;
- following any significant changes to the facility, such as the addition of injection or monitoring wells;
- due to any change in personnel; or
- as required by the UIC Director.

The following attachments are located in *Appendix G*:

- Appendix G-1 Risk Assessment Table
- Appendix G-2 FEMA Flood Zone Hazards Map
- Appendix G-3 Resources and Infrastructure Map