EMERGENCY AND REMEDIAL RESPONSE PLAN
LAC 43:XVII.3623

Project Name: Live Oak CCS Hub

Facility Information

Facility Contact: Live Oak CCS, LLC
14302 FNB Parkway
Omaha, Nebraska 68154
402-691-9500

OOC Code No.: L1135

Well Locations:

Well Name	Latitude (WGS84)	Longitude (WGS84)	Parish	State
LO-01 M[1]	Claimed as PBI	[redacted]	West Baton Rouge	Louisiana
LO-01 F[1]	Claimed as PBI	[redacted]	West Baton Rouge	Louisiana
LO-02 M	Claimed as PBI	[redacted]	West Baton Rouge	Louisiana
LO-03 M	Claimed as PBI	[redacted]	Iberville	Louisiana
LO-04 F-M	Claimed as PBI	[redacted]	Iberville	Louisiana
LO-05 M	Claimed as PBI	[redacted]	Iberville	Louisiana
LO-06 M[1]	Claimed as PBI	[redacted]	Iberville	Louisiana
LO-06 F[1]	Claimed as PBI	[redacted]	Iberville	Louisiana

[1] For shared well pads, surface hole location spacing is set at a minimum of 15 feet.

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List of Acronyms

AoR	Area of Review
BOP	Blowout Prevention
BHP	Bottomhole Pressure
CO_2	Carbon Dioxide
CBL	Cement Bond Log
CR	Corrosion Resistant
DTS	Distributed Temperature Sensing
ERRP	Emergency and Remedial Response Plan
EPA	Environmental Protection Agency
FRS	Facility Registry Service
HAZOP	Hazard and Operability
HAZCOM	Hazard Communication
LOTO	Lockout / Tagout
LOC	Loss of Containment
OC	Louisiana Department of Energy and Natural Resources' Office of Conservation
MMI	Modified Mercalli Intensity
MW	Mud Weight
OSHA	Occupational Safety and Health Administration
PVT	Pit Volume Totalizer
P&A	Plugged and Abandoned
P/T	Pressure & Temperature
PLC	Programmable Logic Controller
PNL	Pulsed-Neutron Logs
SCADA	Supervisory Control and Data Acquisition
UIC	Underground Injection Control
USDW	Underground Source of Drinking Water
UPS	Uninterruptible Power Supply
USGS	United States Geologic Survey

1. Introduction

The purpose of this Emergency and Remedial Response Plan (ERRP) is to meet the requirements of LAC 43:XVII.3623. This document describes the actions that Live Oak CCS, LLC will take to address unplanned movement of the injection fluid or formation fluid that may endanger an underground source of drinking water (USDW) at the Live Oak CCS Hub in Iberville and West Baton Rouge Parishes (the "project"). The described actions will be followed during the construction, operation, or post-injection site care periods of the injection wells permitted by the Louisiana Department of Energy and Natural Resource's Office of Conservation (OC). This plan functions as an addition to emergency management plans associated with the operation and maintenance of surface facilities and is not intended to duplicate the requirements of those plans.

If Live Oak CCS, LLC obtains evidence that the injected CO_2 stream and/or associated pressure front may cause an endangerment to a USDW, Live Oak CCS, LLC will perform the following actions: [LAC 43:XVII.3623(A)(2)]

1. Initiate shutdown plan for the injection well(s).
2. Take all steps reasonably necessary to identify and characterize any release.
3. Notify the OC of the emergency event within 24 hours.
4. Implement applicable portions of the approved ERRP.

Where the phrase "initiate shutdown plan" is used, the following protocol will be employed: Live Oak CCS, LLC will immediately cease injection. However, in some circumstances, Live Oak CCS, LLC will, in consultation with the OC, determine whether gradual cessation of injection (using the parameters set forth in the Summary of Requirements of the Class VI Permit) is appropriate.

2. Local Resources and Infrastructure

Nearby local resources and infrastructure are identified and shown within 1 mile of the project's Area of Review (AoR). Nearby environmental resources that may be affected as a result of an emergency event include: USDWs as described in subsection 2.7 of the Application Narrative, the Choctow Bayou, Intracoastal Waterway, Smith Lake, Bear Bayou, Trinity Drainage Canal, Bayou Bogan, King Ditch, Green Lake, Catfish Canal, Bayou Hopper, Halfway Lake, Port Allen Lock, Grand Bayou, Bayou Maringouin, and Bayou Bourbeaux (Figure 1).

Land parcels within the AoR are generally used for farming, residential, oil and gas production, and industrial activities. Other nearby infrastructure that may be affected as a result of an emergency includes: highways and county roads, cemeteries, railroad, residences, transmission lines, water supply wells, oil and gas wells, natural gas pipelines, and roads associated with the towns of Addis, Rosedale, Grosse Tete, and Brusly (Figure 2 and Figure 3).

Injection wells are not within 500 feet of any corporate limits of municipalities, residential properties, schools, or healthcare facilities, in compliance with Section 1113 of the Louisiana Geologic Sequestration of Carbon Dioxide Act.

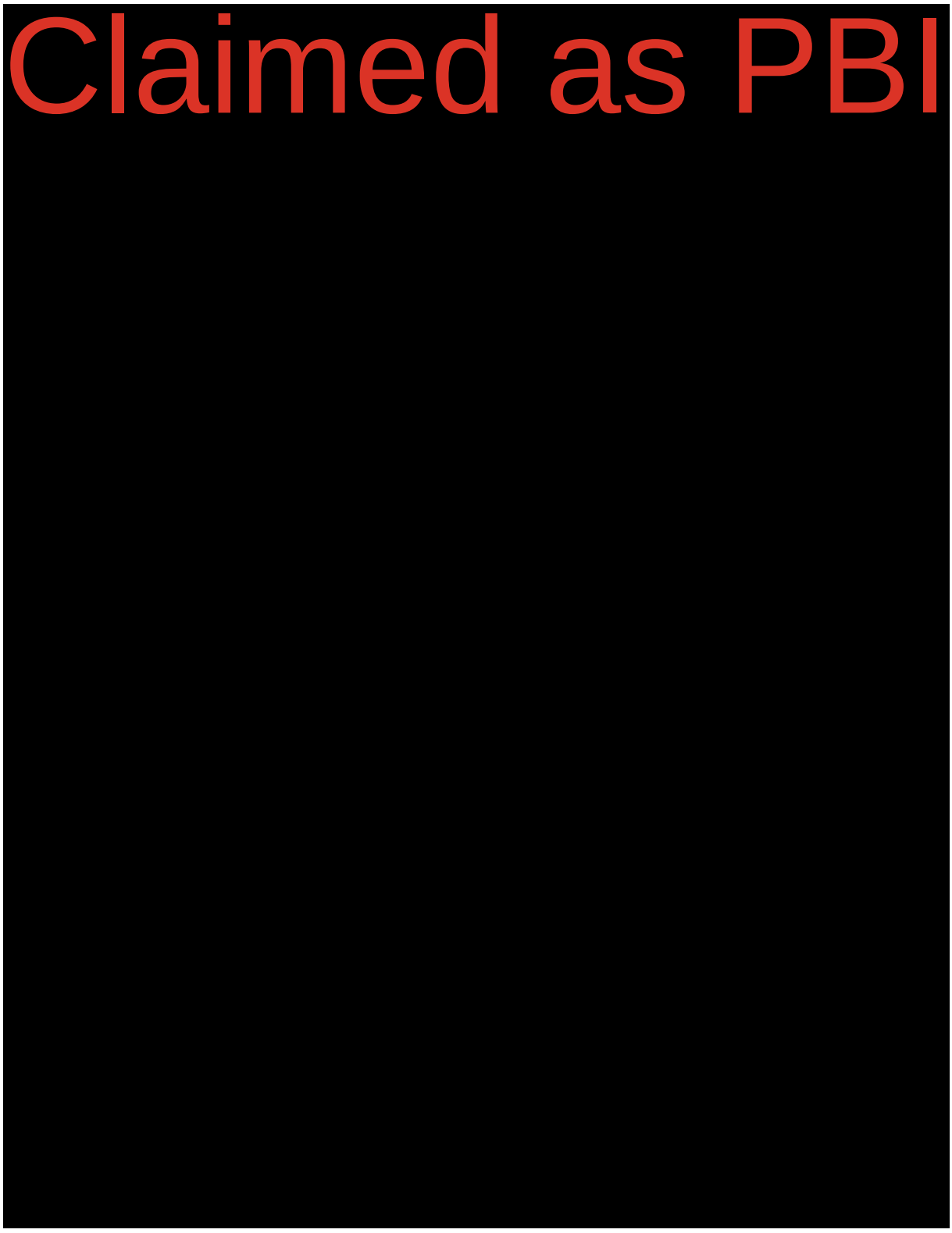

Figure 1. Map of the AoR, 1 mile buffer, Live Oak injection (diamond) and monitoring (circle) wells, conservation areas, and labeled waterbodies.

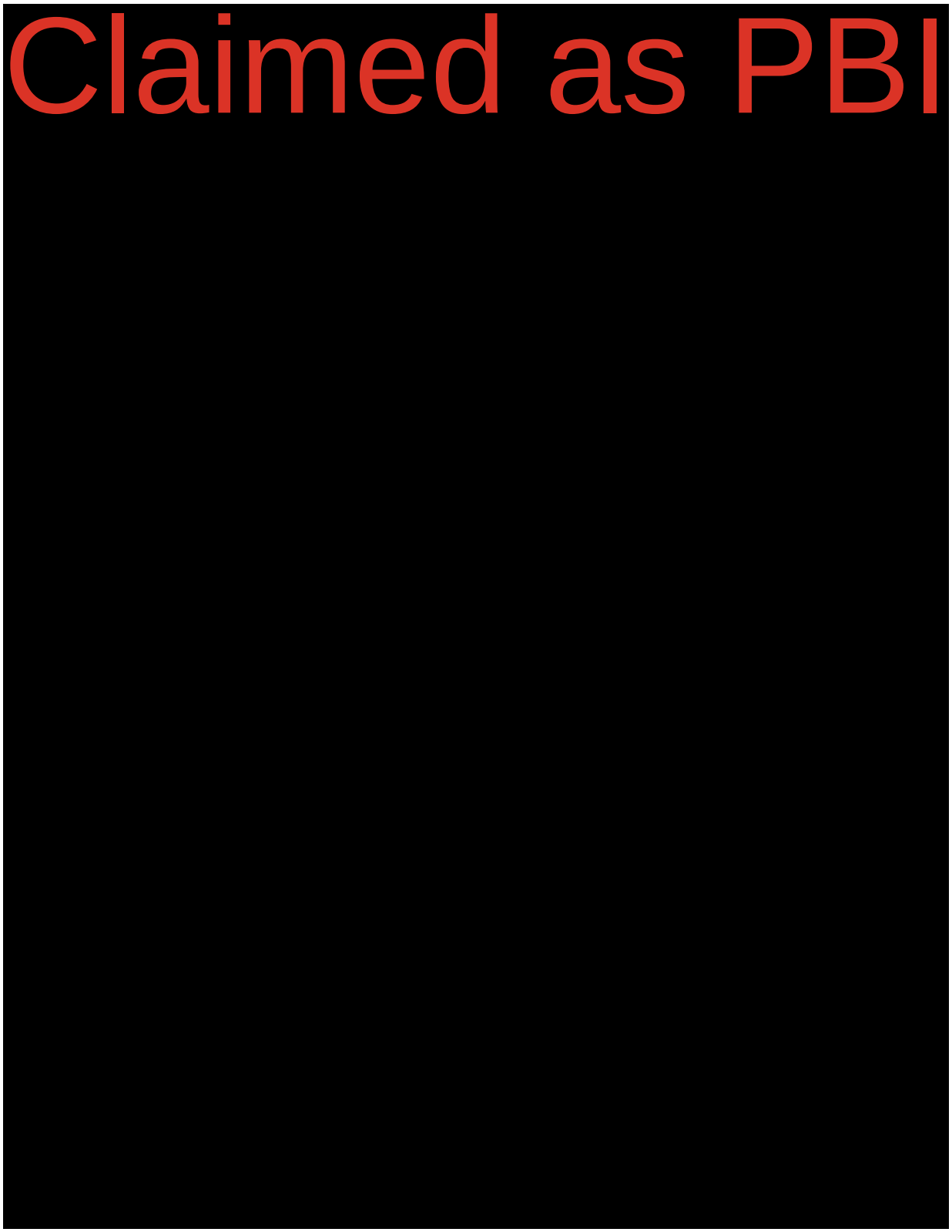

Figure 2. Map of the AoR, 1 mile buffer, Live Oak injection (diamond) and monitoring (circle) wells, cemeteries, pipelines, railroads, and roads.

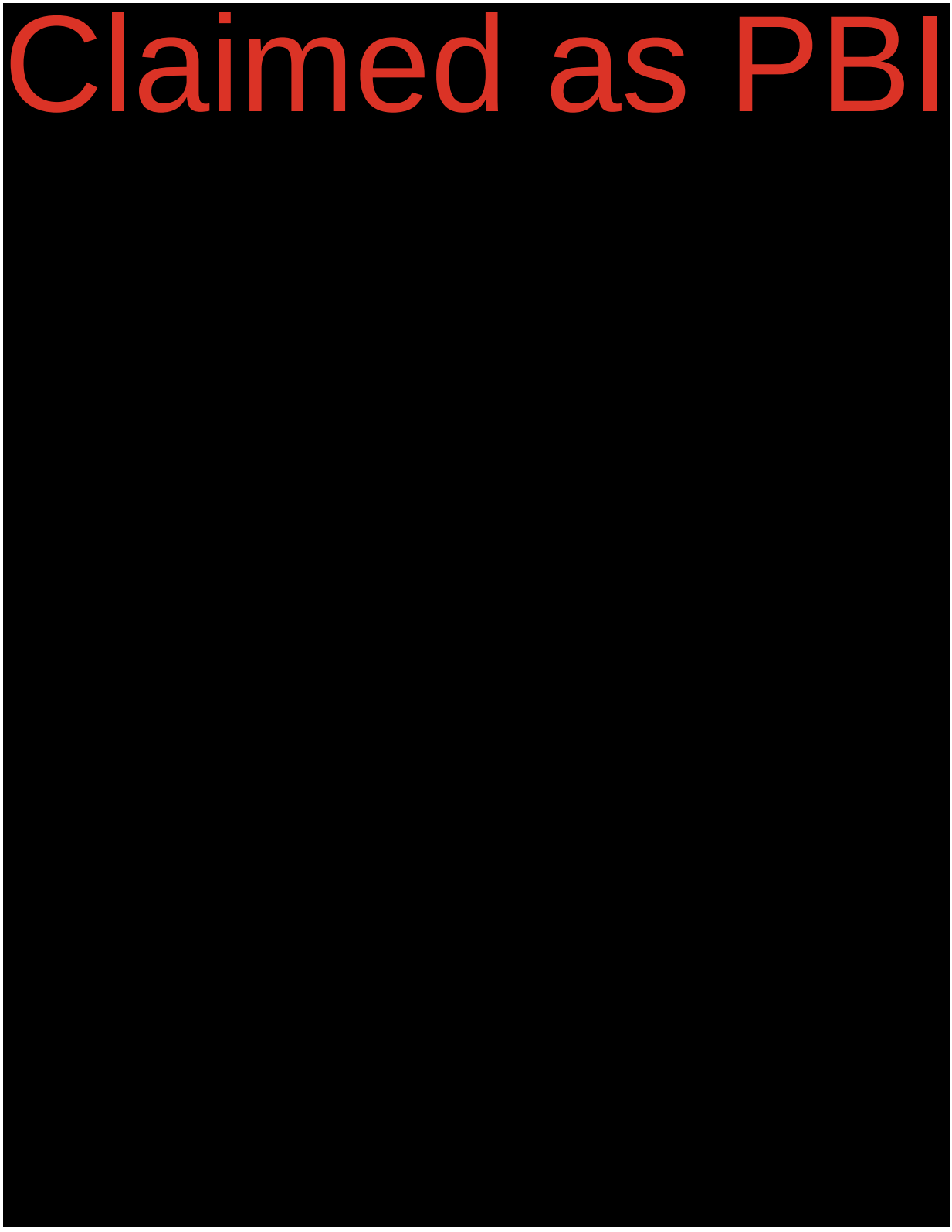

Figure 3. Map of the AoR, 1 mile buffer, Live Oak injection (diamond) and monitoring (circle) wells, water wells, oil and gas wells, municipal boundaries, and structures.

3. Potential Risk Scenarios

The following is a list of events related to the project that could potentially result in an emergency response:

- Injection or monitoring (verification) well integrity failure;
- Injection well monitoring equipment failure (e.g., shut-off valve or pressure gauge, etc.);
- Fluid (e.g., brine) or CO_2 leakage to a USDW or the surface;
- A natural disaster (e.g., hurricane, tornado, lightning strike, wildfire); or
- Induced or natural seismic event.

Response actions will depend on the severity of the event(s) triggering an emergency response. "Emergency events" are categorized as shown in Table 1. A summary for the severity of the outlined scenarios (Appendix A) is shown in Table 2.

Table 1. Degrees of risk for emergency events.

Emergency Condition	Definition
Major emergency	Event poses immediate substantial risk to human health, resources, or infrastructure. Emergency actions involving local authorities (evacuation or isolation of areas) should be initiated.
Serious emergency	Event poses potential serious (or significant) near term risk to human health, resources, or infrastructure if conditions worsen or no response actions taken.
Minor emergency	Event poses no immediate risk to human health, resources, or infrastructure.

Table 2: Summary of risk scenarios and their relative timing, degree of risk, and where response actions are discussed in Appendix A.

Risk Scenario	Construction Period	Injection Period	PISC Period	Degree of Risk	Appendix A Scenario #
Fluid communication between formations while drilling	x			Serious to Major	1 - 3
Fluid leakage into or near USDW or ground surface through wellbore (injection, monitoring, P&A, or other), surface equipment failure, faults, fractures, or confining zone failure		x	x	Minor to Major	4 – 7, 9-15
External impact to project wellheads or pipelines		x	x	Serious to Major	20 - 22
Loss of mechanical integrity (injection or monitoring well)	x	x	x	Minor to Major	4 - 7

Risk Scenario	Construction Period	Injection Period	PISC Period	Degree of Risk	Appendix A Scenario #
Migration of CO_2 outside of defined AOR		x	x	Minor to Major	17 - 19
Injection or monitoring equipment failure/malfunction		x	x	Minor to Serious	23 - 28
Seismic event / earthquake (induced or natural)	x	x	x	Minor to Major	Table 4
Natural disaster (hurricane, tornado, lightning, flood, wildfire)	x	x	x	Minor to Major	16, 29
Accident or unplanned event (e.g., electrical outage causing injection to stop, unauthorized activity)		x		Minor	8, 30 - 31

4. Emergency Identification and Response Actions

Steps to identify and characterize the event will be dependent on the specific issue identified and the severity of the event. The risk scenarios in Table 2, along with their corresponding response actions, are summarized in Appendix A, and emergency contact information is in Appendix B. The appropriate course of action hinges upon both the emergency's nature and its severity. A comprehensive risk assessment will precede any request for operational permission, with a formal report on risk severity furnished to the OC.

The potential risk scenarios specified in Table 2 and response actions in Appendix A are conceptual in nature. Response plans may be subject to adjustment in collaboration with the OC, considering the unique health, safety, and environmental factors of each situation.

4.1 Seismic Sensing

During injection, Live Oak CCS, LLC will monitor the pressure and plume and control injection rates (see Testing and Monitoring Plan); thus it is unlikely that injection operations would induce a seismic event outside a ten (10) mile radius from the wellhead. Therefore, this portion of the response plan is developed for any seismic event with an epicenter within a ten (10) mile radius of the injection wells.

The seismicity of the region is discussed in subsection 2.6 of the Application Narrative. There have been two seismic instances within 100 miles of the injection locations over the last 40 years. The closest was approximately 35 miles from the AoR, and both had a magnitude of 3.0. The AoR is considered to have a low risk of damaging earthquakes on the United States Geologic Survey (USGS) scale, with a 5-25% chance in 100 years of earthquake shaking equivalent to a Modified Mercalli Intensity (MMI) level VI or higher event. These data indicate that the AoR and surrounding area are tectonically stable (see Section 2 of the Application Narrative for additional details).

To monitor the area for seismicity, Live Oak CCS, LLC will rely on the established USGS and State real-time seismic monitoring networks. There are 19 stations within 35 miles of the permitted injection wells shown in Figure 4 and Table 3. Data from these monitoring stations can be viewed at the following website: https://earthquaketrack.com/p/united-states/louisiana/recent#google_vignette.

If a felt event is identified based on local reports or a significant event is located at the injection site using the regional array (M >= 2.0), Live Oak CCS, LLC will, in consultation with the OC, develop an alternate seismicity monitoring plan using additional local geophone deployment.

Based on the periodic analysis of the monitoring data, according to the monitoring schedule, or as otherwise determined by the operator, observed level of seismic activity, and local reporting of felt events, the operator will assign the site an operating state (Table 4). The operating state is determined using threshold criteria that correspond to the site's potential risk and level of seismic activity. The operating state provides operating personnel information about the potential risk of further seismic activity and guides them through a series of response actions.

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Figure 4. Seismic Monitoring Stations near the AoR, keyed to Table 3.

Table 3: Seismic monitoring stations.

Station Code	Name	Lat	Long
HKT	Hockley1 Texas	29.965	-95.838
DWPF	Disney Wilderness Preserve, Florida, USA	28.11	-81.433
WVT	Waverly, Tennessee, USA	36.13	-87.83
101	Station 101, Louisiana, USA	30.16404	-90.8026
102	Station 102, Louisiana, USA	30.16876	-90.8007
103	Station 103, Louisiana, USA	30.16534	-90.7969
104	Station 104, Louisiana, USA	30.16414	-90.7868
105	Station 105, Louisiana, USA	30.16759	-90.7929
106	Station 106, Louisiana, USA	30.16769	-90.7819
107	Station 107, Louisiana, USA	30.17335	-90.7933
107N	Station 107N, Louisiana, USA	30.17457	-90.7931
108	Station 108, Louisiana, USA	30.17953	-90.7879
109	Station 109, Louisiana, USA	30.1758	-90.7954
110	Station 110, Louisiana, USA	30.16979	-90.7824
111	Station 111, Louisiana, USA	30.17842	-90.7796
112	Station 112, Louisiana, USA	30.17418	-90.7738
113	Station 113, Louisiana, USA	30.1888	-90.7866
114	Station 114, Louisiana, USA	30.18877	-90.7662
115	Station 115, Louisiana, USA	30.18498	-90.8004
116	Station 116, Louisiana, USA	30.16636	-90.811
117	Station 117, Louisiana, USA	30.1538	-90.7962
118	Station 118, Louisiana, USA	30.35277	-91.1077

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Table 4. Seismic monitoring system, for seismic events with an epicenter within a ten (10) mile radius of the injection well.

Operating State	Threshold Condition[1,2]	Response Action[3]
Green	Seismic events less than M2.0	1. Continue normal operation within permitted levels.
Yellow	Five (5) or more seismic events within a 30-day period having a magnitude less than or equal to M2.0	1. Continue normal operation within permitted levels. 2. Within 24 hours of the incident, notify the OC of the operating status of the well.
Orange	Seismic event greater than M2.0 and no felt report	1. Continue normal operation within permitted levels. 2. Within 24 hours of the incident, notify the OC, of the operating status of the well. 3. Review seismic and operational data. 4. Report findings to the OC and issue corrective actions.

[1] Specified magnitudes refer to magnitudes determined by USGS seismic monitoring stations or reported by the USGS National Earthquake Information Center using the national seismic network. *USGS open file report 2008-1262*.

[2] "Felt report" and "local observation and report" refer to events confirmed by local reports of felt ground motion or reported on the USGS "Did You Feel It?" reporting system.

[3] Reporting findings to the OC and issuing corrective action will occur within 25 business days (five weeks) of change in operating state.

Operating State	Threshold Condition[1,2]	Response Action[3]
Magenta	Seismic event greater than M2.0 and local observation or report	1. Initiate rate reduction plan. 2. Vent CO_2 from surface facilities if required. 3. Within 24 hours of the incident, notify the OC of the operating status of the well. 4. Limit access to wellhead to authorized personnel only. 5. Communicate with facility personnel and local authorities to initiate evacuation plans, as necessary. 6. Monitor well pressure, temperature, and annulus pressure to verify well status and determine the cause and extent of any failure; identify and implement appropriate remedial actions (in consultation with the OC). 7. Determine if leaks to groundwater or surface water occurred. 8. If USDW contamination is detected: a. Notify the State Police and OC within 24 hours of the determination. b. Initiate Shutdown Plan. c. Shut in well (close flow valve) d. Vent CO_2 from surface facilities e. Identify and implement appropriate remedial actions (in consultation with OC) 9. Review seismic and operational data. 10. Report findings to the OC and issue corrective actions.
Red	Seismic event greater than M2.0, and local observation or report, and local report and confirmation of damage[4] Seismic event >M3.5	1. Initiate shutdown plan. 2. Vent CO_2 from surface facilities if required. 3. Within 24 hours of the incident, notify the OC of the operating status of the well. 4. Limit access to wellhead to authorized personnel only. 5. Communicate with facility personnel and local authorities to initiate evacuation plans, as necessary. 6. Monitor well pressure, temperature, and annulus pressure to verify well status and determine the cause and extent of any failure; identify and implement appropriate remedial actions (in consultation with the OC). 7. Determine if leaks to ground water or surface water occurred. 8. If USDW contamination is detected: a. Notify the State Police and OC within 24 hours of the determination. b. Identify and implement appropriate remedial actions (in consultation with the OC). 9. Review seismic and operational data. 10. Report findings to the OC and issue corrective actions.

[4] Onset of damage is defined as cosmetic damage to structures, such as bricks dislodged from chimneys and parapet walls, broken windows, and fallen objects from walls, shelves, and cabinets.

5. Response Personnel and Equipment

The Project Manager during construction or the Operations Manager during operation and post-injection is responsible for implementing this ERRP. Project personnel and local authorities will also be relied upon to implement this ERRP.

The Project Manager during construction or the Operations Manager during operation and post-injection is the 24-Hour Emergency Contact for the project. A site-specific emergency contact list (Appendix B) will be maintained during the life of the project and will be updated at least annually as described in Section 6 below.

Equipment needed in the event of an emergency and remedial response will vary, depending on the triggering emergency event. Response actions (cessation of injection, well shut-in, and evacuation) will generally not require specialized equipment to implement. Where specialized equipment (such as a drilling rig or logging equipment) is required, Live Oak CCS, LLC will be responsible for procurement of any necessary additional specialized equipment (e.g., drilling rigs or logging equipment).

6. Emergency Communications Plan

Prior to beginning injection, Live Oak CCS, LLC will work with the Office of Homeland Security and Emergency Preparedness Director for West Baton Rouge and Iberville parishes to seek approval of this ERRP and establish a community notification system that includes coordination with emergency preparedness and response agencies designated by the parishes. Also prior to beginning injection, Live Oak CCS, LLC in coordination with these local agencies will conduct one tabletop exercise that simulates emergency situations and responses in accordance with the approved ERRP. [Section 1107.2 of the Louisiana Geologic Sequestration of Carbon Dioxide Act]

Emergency communication will be contingent upon the emergency type and the notification criteria outlined in Appendix A. In the event of an emergency, Live Oak CCS, LLC will provide the following notifications (see contact information in Appendix B): [LAC 43:XVII.3629(A)(1)(c); LAC 33:V.10111(B); UIC Incident Report form]

- If the emergency is determined to be major (see Table 1 above), immediately notify local emergency responders;
- Immediately notify the 24-Hour Emergency Contact;
- If the emergency is determined to be serious or major (see Table 1 above), notify the State Police and OC within 24 hours; and
- Submit a UIC Incident Report to the OC. The form is available at the following website: https://www.dnr.louisiana.gov/assets/OC/im_div/uic_sec/UIC_Incident_Report.pdf.

Live Oak CCS, LLC will maintain site-specific maps of well locations and access roads that will be readily available for local emergency responders.

The State Police must be notified in the event of a release or incident that meets at least one of the following criteria: [LAC 33:V.10111(B)]

- Release directly causes any injury requiring hospitalization or any fatality;
- Release results in a fire or explosion which could reasonably be expected to affect the public safety beyond the boundaries of the facility;
- Release exceeds the reportable quantity for CO_2 (1,000 lbs) during any continuous 24-hour period when that reportable quantity could be reasonably expected to escape beyond the facility;
- Incident, accident, or cleanup within a facility could reasonably be expected to affect the public safety beyond the boundaries of the facility; or
- Live Oak CCS, LLC knows a protection action beyond the facility has been initiated.

Live Oak CCS, LLC will communicate to the public about any event that requires an emergency response to ensure that the public understands what happened and whether or not there are any environmental or safety implications. The amount of information, timing, and communications method(s) will be appropriate to the event, its severity, whether any impacts to drinking water or other environmental resources occurred, any impacts to the surrounding community, and their awareness of the event.

Live Oak CCS, LLC will describe what happened, any impacts to the environment or other local resources, how the event was investigated, what responses were taken, and the status of the response. For responses that occur over the long-term (e.g., ongoing cleanups), Live Oak CCS, LLC will provide periodic updates on the progress of the response action(s).

Live Oak CCS, LLC will also communicate with entities who may need to be informed about or take action in response to the event, including local water systems, CO_2 source(s) and pipeline operators, landowners, and Regional Response Teams (as part of the National Response Team).

7. Plan Review

This ERRP shall be reviewed:

- At least once every five (5) years following its approval by the OC;
- Within one (1) year of an AoR reevaluation;
- Following any significant changes to the injection process or the injection facility; or
- As required by the OC; and
- At least annually for the Emergency Contact List in Appendix B of this ERRP.

An amended ERRP should be submitted to the OC within 1 year of an AoR reevaluation, following any significant changes to the facility, or when required by the OC. Amendments must be approved by the OC and incorporated into the permit and are subject to permit modification requirements. If the review indicates that no amendments to the ERRP are necessary, Live Oak CCS, LLC will provide the OC with the documentation supporting the "no amendment necessary" determination. Updating the Emergency Contact List and clarifications or corrections are not considered an amendment to the ERRP and do not require permit modification (LAC 43: XVII.3613(D)).

8. Staff Training and Exercise Procedures

Live Oak CCS, LLC will integrate the ERRP into its existing operating procedures and training protocols. Live Oak CCS, LLC will determine the required training programs for each employee commensurate with their job function, safety requirements, and regulatory requirements. All employees at Live Oak CCS Hub will be trained—this training will be documented prior to commencing injection. Live Oak CCS, LLC will hold safety meetings with each contractor prior to commencement of any new contract work on the project with emergency measures specific to the contractor's work explained. Live Oak CCS, LLC will provide information about employee training status, schedules, and coursework to regulatory authorities upon request and prior to commencing injection.

Live Oak CCS, LLC intends to provide training courses for field personnel that may include, but are not limited to:

- Emergency action planning
- Hazard communication (HAZCOM)
- Basic fire extinguishers
- Major emergency response
- OSHA 10-hour and 30-hour general industry
- Cardiopulmonary resuscitation (CPR)
- Risk management for oil and gas field operations

Periodic training will be provided, not less than annually, to construction personnel, well operators, maintenance personnel, project safety personnel, environmental personnel, the operations manager, and corporate communications, in compliance with Section 1107.2 of the Louisiana Geologic Sequestration of Carbon Dioxide Act. The training plan will record that the necessary personnel have been trained and possess the required skills to perform their relevant emergency response activities described in the ERRP.

Appendix A: Emergency Remedial and Response Risk Scenarios

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
1	Construction Period	Fluid Leakage - Drilling operations: Hydrostatic column controlling the well decreases below the formation pressure, resulting in a sudden influx of fluid, causing a well control event with loss of containment.	• Flow sensor • Pressure sensor • Tank level indicator • Tripping displacement practices • Mud weight control	• Blowout prevention (BOP) equipment • Kill fluid • Well control training • BOP drills • BOP testing protocol • Kick drill • Lubricators for wireline operations	**Drilling:** • Stop operation • Close BOP • Clear floor and secure area • Execute well control procedure • Evaluate drilling parameters to identify root cause • If major emergency, call 911 • Notify 24-Hour Emergency Contact, State Police, and OC and propose an action plan based on the finding • Submit UIC Incident Report • Continue operations **Completion:** • Stop operations • Close BOP • Clear floor and secure area • Execute well control procedure • If major emergency, call 911 • Notify 24-Hour Emergency Contact, State Police, and OC and propose remediation plans. • Submit UIC Incident Report • Continue operations • In case of influx, control the well, without compromising the shoe integrity • In the case of the shoe leaking, squeeze to regain integrity • In the case of the surface casing leaking, squeeze or install a casing patch.	• Project manager • Rig crew • Rig manager • Field superintendent

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
2	Construction Period	Fluid Leakage - Drilling operations: Failure of protective casings or cement while drilling. resulting in invasion by drilling fluid or cross flow of non-native formation fluid into the underground source of drinking water (USDW).	• Pressure sensors • Cement bond log (CBL) • Rig pit volume totalizer (PVT) system	• Pressure sensors • USDW will be covered with casing(s) cemented to surface • Pressure test of casing when cement has achieved appropriate compressive strength to assess integrity • CBL to confirm cement bonding	• In the case of the shoe leaking, squeeze to regain integrity • In the case of the surface casing leaking, squeeze or install a casing patch. • If major emergency, call 911 • Notify 24-Hour Emergency Contact, State Police, and OC within 24 hours and propose remediation plans. • Submit UIC Incident Report	• Project manager • Rig crew • Rig manager • Field superintendent
3	Construction Period	Unauthorized access/activity: Unauthorized activity on field site	• Field personnel logs	• Fencing around well sites • Security in place	• Report any incidents to local Sheriff's office • Submit UIC Incident Report	• Field superintendent • Company man
4	Construction Period	Fluid Leakage - Drilling through USDW: Improper well control during the drilling of one or more monitoring or injection wells. Excessive overbalance exceeds the aquifer reservoir or fracture propagation pressure, and the drilling fluid migrates into the USDW. Improperly handled kick from loss of overbalance causes formation failure in USDW.	• Flow sensor • Pressure sensor • Mud weight control • Rig pit volume totalizer (PVT) system	• Well control training • Drilling fluid program • Sufficient drilling fluid reserve • Rig solids control system	• Suspend drilling operation • Close BOP • Clear floor and secure area • Execute well control procedure • Evaluate drilling parameters to identify root cause • If major emergency, call 911 • Notify 24-Hour Emergency Contact and OC within 24 hours and propose remediation plans. • Submit UIC Incident Report • Implement corrective actions • Continue operations	• Project manager • Rig crew • Rig manager • Field superintendent
5	Injection Period	Fluid Leakage – UIC Wellbores:A loss of mechanical integrity in the injection well causing a tubing/packer to leak due to corrosion damage, damage to the tubulars during installation, fatigue,higher load profiles, and other issues, that could cause communication of formation fluids with the annularcasing tubing as well as sustained casing pressure. There is no loss of containment (LOC) in this scenario.	• Pressure and temperature gauges on surface and downhole real time• Pulsed-neutron logs • Annular pressure test CO_2 leak sensors on the wellhead	• Tubing at 13CR or coated • Inhibited packer fluid in annulus • Corrosion monitoring plan • Dry CO_2 injected • 13CR packers • CR tubing tailpipes below packers • New tubing or inspection of tubing before reinstalling	• Trigger Emergency Shutdown system • SCADA alarms notification to operations staff • Follow protocol to stop operation, vent, or deviate CO_2 • Notify 24-Hour Emergency Contact • Troubleshoot the well • If tubing leak is detected, notify OC and propose an action plan based on the finding • Submit UIC Incident Report • Schedule well service to repair tubing	• Operations manager • Field superintendent • Project manager

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
6	Injection/ Post Injection Site Care Period	Fluid Leakage – MW Wellbores A loss of mechanical integrity in the monitoring well causing a tubing/packer to leak due to corrosion damage, damage to the tubulars during installation, fatigue, higher load profiles, and others and could cause a communication of the formation fluids with the annular casing tubing as well as sustained casing pressure. There is no LOC in this scenario.	• Pressure and temperature gauges on surface and downhole real time • Pulsed-neutron logs • Annular pressure test. CO_2 leak sensors on the wellhead	• Tubing at 13CR or coated • Inhibited packer fluid in annulus • Corrosion monitoring plan • 13CR packers • CR tubing below/between packers • CR or Inconel carrier for the sensors • New tubing or inspection of tubing before reinstalling • Cased hole logging program • Observation wells are designed to be outside of the projected plume for most of the project which reduces the risk of contact with CO_2	• Trigger Emergency Shutdown system • SCADA alarms notification to operations staff • Notify 24-Hour Emergency Contact • Troubleshoot the well • Notify OC and propose an action plan for well service •Schedule well service to repair tubing, isolate CO_2 zone, or abandon the well	• Operations manager • Field superintendent • Project manager •Rig crew and service contractors
7	Injection Period	Fluid Leakage – UIC Wellbores: A loss of mechanical integrity in the injection wells causing a casing leak due to corrosion, damage in the tubulars during installation, fatigue, higher load profiles, or others. This event could cause migration of CO_2 and brines through the casing, the cement sheet, and into different formations of the injection target or into USDW.	• Pressure and temperature gauges on surface and downhole real time • CO_2 leak sensors on the wellhead • DTS fiber real time alongside the casing • Flow rate monitoring • Pulsed-neutron logs • CBL/Ultra-sonic logging • USDW water monitoring	• CO_2-resistant cement and metallurgic across injection zone • Injection through tubing and packer • Inhibited packer fluid in the annular • Cement to surface • Corrosion monitoring plan • Cased hole logging program • New casing and tubing installed	• Trigger Emergency Shutdown system • SCADA alarms notification to operations staff • Follow protocol to stop operation, vent, or deviate CO_2 • If major emergency, call 911 • Notify 24-Hour Emergency Contact • Troubleshoot the well. • Evaluate if there is a movement of CO_2 or brines to USDW. In the remote event that USDW is affected, notify State Police and OC within 24 hours and propose remediation plans • Submit UIC Incident Report • Schedule well service to repair the casing	• Operations manager • Field superintendent • Project manager • Rig crew and service contractors • Remediation contractors
8	Injection period	Unauthorized access/activity: Unauthorized activity on filed site	• Field personnel logs	• Fencing around well sites • Security in place	• Report any incidents to local Sheriff's office • Submit UIC Incident Report	• Field superintendent • Company man

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
9	Injection Period/ Post Injection Site Care Period	Fluid Leakage – MW Wellbores:A loss of mechanical integrity in the monitoring well causing a casing leak due to corrosion, damage in the tubulars during installation, fatigue, higher load profiles, and others. This event could cause a migration of CO_2 and brines through the casing, the cement sheet, and into different formations of the injection target or into USDW.	• Pressure and temperature gauges on surface and downhole real time • CO_2 leak sensors on the wellhead • Pulsed-neutron logs • CBL/Ultra-sonic logging • USDW water monitoring	• CO_2-resistant cement across injection zone • 13CR packers • Inhibited packer fluid in the annular • Cement to surface • Corrosion monitoring plan • Cased hole logging program • New casing • New or inspected tubing before reinstallation • Observation wells are designed to be outside of the projected plume for most of the project's life cycle which minimizes the risk of contact with CO_2	• Trigger Emergency Shutdown system • SCADA alarms notification to operations staff • Notify 24-Hour Emergency Contact • Troubleshoot the well • Evaluate if there is a movement of CO_2 or brines to USDW. In the remote event that USDW is affected, notify State Police and OC within 24 hours and propose remediation plans • Submit UIC Incident Report • Schedule well service to repair the casing	• Operations manager • Field superintendent • Project manager • Rig crew and service contractors • Remediation contractors
10	Injection Period / Post Injection Site Care Period	Fluid Leakage – Legacy Wellbores: Brines and CO_2 could migrate through poor cement bonding, cement degradation, or cracking in the cement of plugged and abandoned (P&A) wells.	• USDW water sampling • Pulsed-neutron logs	• Legacy wells are properly abandoned for brine movement because of pressurization of injection zone • Injectors will be abandoned as soon as CO_2 injection ends, except if they are left as observation wells	• Notify 24-Hour Emergency Contact • Evaluate if it's a positive CO_2 release because of a leak in the legacy/P&A well • Notify State Police and OC within 24 hours and propose remediation plans • Submit UIC Incident Report	• Operations manager • Field superintendent • Project manager • Rig crew and service contractors • Remediation
11	Injection	Fluid Leakage – Faults and Fractures: During injection, the pressurization of the injection zone exceeds the sealing capacity of the confining zone above or if there are features such as fault or fractures that are reactivated. Creating a leakage pathway for CO_2 and brine to migrate to a shallower formation, including a USDW.	• USDW water sampling • Pulsed-neutron log in injector and observation wells	• Injection is limited to 90% of frac gradient • Extensive characterization of the rocks shows good sealing capacity • If the confining zone above the Lower Miocene Sands fails, the Middle and lower part of the Upper Miocene Shales will act as buffers before CO_2 or brines are able to reach the USDW	• Follow protocol to stop injection. • If major emergency, call 911 • Notify 24-Hour Emergency Contact, State Police, and OC within 24 hours and propose remediation plans • Assess root cause by reviewing monitoring data • Submit UIC Incident Report • If necessary, conduct geophysical survey to delineate potential leak path • Evaluate if there is a movement of CO_2 or brines to USDW. If USDW is affected, discuss with OC remediation options, action plan, and monitoring program. • Actions to restore injection will depend on the nature of the leak path and the extent. Operator needs to reevaluate model and discuss action plan with OC	• Operations manager • Field superintendent • Geologist • Reservoir engineer • Project manager • Remediation contractors

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
12	Injection Period	Fluid Leakage - Geomechanical Seal Failure Elevated well bottomhole pressure (BHP) either exceeds the permitted maximum injection pressure or the estimated maximum injection pressure is inaccurate (i.e., the true fracture pressure is lower than the estimated maximum pressure) in the injection zone, resulting in the failure of the confining system and leading to vertical migration of CO_2 or brine to a USDW, the surface or atmosphere (CO_2 only).	• Pressure gauges on surface and downhole real time • USDW water sampling • Pulsed-neutron log in injector and observation wells	• Injection is limited to less than 90% of the fracture gradient • Core and geomechanical testing and geochemical modeling of the upper confining zone show good sealing capacity and fluid compatibility, respectively • If the confining zone above the Lower Miocene Sands fails, the Middle and lower part of the Upper Miocene Shales will act as buffers before CO_2 or brines are able to reach the USDW • Microfracture test prior to receiving authorization to operate, confirm formation breakdown pressure.	• Trigger Emergency Shutdown system • SCADA alarms notification to operations staff • Follow protocol to stop injection • Designate an exclusion zone, and provide appropriate PPE for protection of onsite personnel • If major emergency, call 911 • Notify 24-Hour Emergency Contact, State Police, and OC within 24 hours and propose remediation plans • Assess root cause by reviewing monitoring data • Submit UIC Incident Report • If required, conduct geophysical survey to delineate potential leakage pathway • Evaluate if there is a movement of CO_2 or brines to USDW. • Notify OC and propose remediation options, action plan, and monitoring program • Actions to restore injection will depend on the nature of the leak path and the extent. Operator needs to reevaluate model and discuss action plan with OC	• Operations manager • Field superintendent • Monitoring staff • Geologist • Reservoir engineer • Project manager • Remediation contractors

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
13	Injection Period	Fluid Leakage - Surface Infrastructure: Vehicle strikes other surface equipment (e.g., tank battery pumps/compressors, etc.), causing the release of CO_2 at the surface.	• Use of protective equipment, such as bollards, fences, locking gates • Use of appropriate fencing and signage	• Temperature-controlled building and/or containment, as required by regulation or law, will be proposed to protect the surface equipment and other instrumentation (i.e., interrogator, gauges, meters, etc.).	• Trigger Emergency Shutdown system • SCADA alarms notification to operations staff • Designate an exclusion zone, and provide appropriate PPE for protection of onsite personnel • If major emergency, call 911 • Follow protocol to shut down CO_2 delivery • If there are injured personnel, call emergency team, and execute evacuation protocol • Notify 24-Hour Emergency Contact, State Police, and OC within 24 hours and propose remediation plans • Clear location and secure the perimeter. If possible, install containment devices around the location. • Evaluate environmental impact (soil, water, fauna, vegetation), • Assess mechanical integrity of the system • Submit UIC Incident Report • Repair or replace equipment	• Operations manager • Field superintendent • Project manager • Plant manager • Remediation contractors
14	Injection Period	Fluid Leakage - Surface Infrastructure: Failure of a valve results in leakage of CO_2 with potential impacts to health, safety, and the environment, particularly if the leak is not detected and corrected.	• Routine field inspections • Routine inspection of emergency alert systems, monitoring systems and controls.	• Equipment upstream or downstream of the failed valve can be used to isolate the problem as necessary • Preventative maintenance • Periodic inspections	• Trigger Emergency Shutdown system • SCADA alarms notification to operations staff • If major emergency, call 911 • If there are injured personnel, call emergency team, and execute evacuation protocol • Notify 24-Hour Emergency Contact, State Police, and OC within 24 hours and propose remediation plans • Clear location and secure the perimeter. If possible, install containment devices around the location. • Evaluate environmental impact • Assess mechanical integrity of the system • Submit UIC Incident Report • Repair or replace equipment	• Operations manager • Field superintendent • Plant manager • Remediation contractors • Emergency teams

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
15	Injection Period	Fluid Leakage – Surface Infrastructure: The CO_2 stream is blocked between valves on the surface, heated (e.g., by the sun), and expands to rupture the line or flowline on the site is plugged and the pressure sensor fails to detect the change, resulting in a CO_2 leak.	• Pressure, temperature, and flowmeter sensors in real time • Field inspections	• Relief valves (e.g., Pressure Safety Valves) in areas where this is a risk as part of the design process • Equipment upstream or downstream of the failed valve can be used to isolate the problem as necessary • Cleaning protocols: - Wiping the lines- Testing with water - Performing cleaning runs to remove any debris. • Witches hat (cone strainer) filters can be used to filter out large pieces of debris on startup	• Trigger Emergency isolation valves • SCADA alarms notification to operations staff • Follow protocol to shut down CO_2 delivery • If major emergency, call 911 • If there are injured personnel, call emergency team, and execute evacuation protocol • Notify 24-Hour Emergency Contact, State Police, and OC within 24 hours and propose remediation plans • Clear location and secure the perimeter. If possible, install containment devices around the location • Evaluate environmental impact (soil, water, fauna, vegetation), • Assess mechanical integrity of the system • Submit UIC Incident Report • Repair or replace equipment	• Operations manager • Field superintendent • Plant manager • Remediation contractors
16	Injection Period	Fluid Leakage – Natural Disaster: A natural disaster event - e.g., hurricane, lightning, tornadoes, floods, landslides – impacts the pipelines or flowlines at the storage location, forcing the release of CO_2 at the surface.	• Pressure and flowmeter sensors in real time • Field inspections	• HAZOP review • ESD valve installed near the wellhead so it will cease injection if any leak occurs downstream or upstream of the ESD • Weather monitoring	• Trigger Emergency isolation valves • SCADA alarms notification to operations staff • Follow protocol to shut down CO_2 delivery if the automatic shutoff device is not functional • If major emergency, call 911 • If there are injured personnel, call emergency team, and execute evacuation protocol • Notify 24-Hour Emergency Contact, State Police, and OC within 24 hours and propose remediation plans • Clear the location and secure the perimeter. If possible, install containment devices around the location. • Assess mechanical integrity of the pipelines or flowlines • Evaluate environmental impact (soil, water, fauna, vegetation) • Assess mechanical integrity of the system • Submit UIC Incident Report • Install additional monitoring system as needed	• Operations manager • Field superintendent • Project manager • Remediation contractors • Emergency teams

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
17	Injection Period	Fluid Leakage – Surface Infrastructure: Failure of infield pipeline	• Surface P/T gauges and flowmeters at inlet and delivery point.	• Preventive maintenance • Periodic inspections • Monitoring devices at both ends of the transmission pipeline and flowline	• Trigger emergency isolation valves • SCADA alarms notification to operations staff • Follow protocol to shut down CO_2 delivery • Detect CO_2 stream release and its location • If major emergency, call 911and initiate evacuation plan • Notify 24-Hour Emergency Contact and if necessary State Police and OC within 24 hours and propose action plan • Transmission line and/or flowline failure will be inspected to determine the root cause of the failure • Repair/replace the damaged transmission line or flowline, and if warranted, put in place the measures necessary to eliminate such events in the future	• Operations manager • Field superintendent • Remediation contractors • Emergency teams • Plant manager/ • contact
18	Injection Period	Loss of Containment - Vertical Migration via injection well: During the life of the injector wells, there are induced stresses and chemical reactions on the tubulars and cement exposed to the CO_2 pressure and plume. Changes in temperature and injection pressure create stresses in the tubulars trying to expand or contract, and it can lead to micro-annulus effects, resulting in fugitive movement of brines/CO_2.	• CO_2 leak sensors on the wellhead • DTS fiber real time alongside the casing • USDW water monitoring • Pulsed-neutron logs (PNL) to be run for external integrity • CBL/Ultra-sonic logging • Pressure gauges at surface • Flow rate monitoring	• CO_2-resistant cement and metallurgic across injection zone • Injection through tubing and packer, 13CR or better tubing and 13CR packers. • Cement to surface • Cased hole logging program • USDW covered as second barrier with surface casing and surface cement sheet • New casing installed, 13CR or better.	• Trigger Emergency Shutdown system • SCADA alarms notification to operations staff • Follow protocol to stop operation, vent, or deviate CO_2 • Notify 24-Hour Emergency Contact • Troubleshoot the well • Evaluate if there is a movement of CO_2 or brines to USDW and if so, notify State Police and OC within 24 hours and discuss action plan to repair the well or P&A based on the findings of the assessment • Submit UIC Incident Report	• Operations manager • Field superintendent • Project manager • Rig crew and service contractors • Remediation contractors

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
19	Injection Period/ Post Injection Site Care Period	Loss of Containment - Vertical Migration via monitoring well: During the life of the injector wells, there are induced stresses and chemical reactions on thetubulars and cement exposed to the CO_2 pressure and plume. Changes in temperature and injection pressure create stresses in the tubulars trying to expand or contract, and it can lead to micro-annulus effects, resulting in fugitive movement of brines/CO_2	• CO_2 leak sensors on the wellhead • USDW water monitoring • Pulsed-neutron logs to be run for external integrity • CBL/Ultra-sonic logging • Pressure gauges at surface	• CO_2-resistant cement across injection zone • Cement to surface • Case hole logging program • USDW covered as second barrier with surface casing and surface cement sheet • New casing installed, 13CR or better. • Observation wells are designed to be outside of the plume for most of the injection period	• Trigger Emergency Shutdown system • SCADA alarms notification to operations staff • Notify 24-Hour Emergency Contact • Troubleshoot the well. • Evaluate if there is a movement of CO_2 or brines to USDW and if so, notify State Police and OC within 24 hours and discuss action plan to repair the well or P&A based on the findings of the assessment • Submit UIC Incident Report	• Operations manager • Field superintendent • Project manager • Rig crew and service contractors • Remediation contractors

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
20	Injection Period/ Post Injection Site Care Period	Loss of Containment-Lateral Migration of CO_2 Outside Defined AOR: The CO_2 plume moves faster or in an unexpected pattern and expands beyond the secured pore space for the project and the AOR.	• Pulsed-neutron logs in observation wells • Pressure and temperature gauges real time in observation wells	• Detailed geologic model with stratigraphic wells as calibration • Seismic survey integrated in the model • Extensive characterization of the rocks and formation • Periodic review of CO_2 and pressure plume within AOR every 5 years • Monitor the plume over PISC	**Injection period:** • Trigger Emergency Shutdown system • SCADA alarms notification to operations staff • Notify 24-Hour Emergency Contact • Review monitoring data and trends and compare with the simulation. • Notify OC, propose action plan and request to keep injection process while AOR is reviewed, if the data show that CO_2 will stay in the secured pore space • Submit UIC Incident Report .• Perform logging in observation wells. • Conduct geophysical survey as required to evaluate AOR. • Recalibrate model and simulate new AOR • Assess if additional corrective actions are needed and if actions arerequired to secure additional pore space • Assess if any remediation is needed, and discuss action plan with OC • Present AOR review to OC for approval and adjust monitoring plan **Post Injection Site Care Period:** • SCADA alarms notification to monitoring personnel • Notify 24-Hour Emergency Contact • Review monitoring data and trends, compare with the simulation • Notify OC and propose action plan • Submit UIC Incident Report • Conduct geophysical survey as required to evaluate AOR • Recalibrate model, and simulate new AOR • Assess if additional corrective actions are needed and if it's required to secure additional pore space •Assess if any remediation is needed, and discuss action plan with OC	• Operations manager • Field superintendent • Geologist • Reservoir engineers • Project manager

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
21	Injection Period/Post Injection Site Care Period	Containment- Pressure Propagation: A "pressure front" that exceeds the minimum pressure necessary to cause fluid flow from the injection zone into a USDW through a hypothetical conduit (i.e., an artificial penetration that is perforated in both intervals).	• Pulsed-neutron logs • Pressure gauges on surface and downhole real time • USDW water monitoring • Flow rate monitoring • Incremental leakage modeling to validate a lack of potential for fluid movement into the USDW.	• Detailed geologic model with stratigraphic wells as calibration • Seismic survey integrated in the model • Extensive characterization of the rocks and formation • Periodic review of CO_2 and pressure plume within AOR every 5 years • Monitor the plume until stabilization (min 10 years) • USDW covered as second barrier with surface casing and surface cement sheet • Cased hole logging program	**Injection period:** • Identification by monitoring staff • Notify 24-Hour Emergency Contact • Review monitoring data and trends and compare with the simulation • If endangerment to USDW is suspected follow shut down procedure and notify State Police and OC within 24 hours and propose action plan and request to keep injection process while AOR is reviewed, if the data shows that the CO_2 will stay in the secured pore space • Submit UIC Incident Report • Perform logging in observation wells • Conduct geophysical survey as required to evaluate AOR • Recalibrate model and simulate new AOR • Assess if additional corrective actions are needed and if it's required to secure additional pore space • Assess if any remediation is needed, and discuss action plan with OC • Present AOR review to OC for approval and adjust monitoring plan **Post Injection Site Care Period**: • Identification by monitoring staff • Notify 24-Hour Emergency Contact • Evaluate if there is a movement of CO_2 or brines to USDW. In the remote event that USDW is affected, notify State Police and OC within 24 hours and discuss remediation options with the OC • Submit UIC Incident Report • Review monitoring data and trends and compare with simulations • Conduct geophysical survey as required to evaluate AOR • Recalibrate model, and simulate new AOR • Assess if additional corrective actions are needed and if it's required to secure additional pore space	• Operations manager • Field superintendent • Monitoring staff • Geologist • Reservoir engineers • Project manager • Remediation contractors

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
22	Injection Period	External impact – UIC Well:During injection, the wellhead is hit by a massive object that causes major damage to the equipment. The well gets disconnected from the pipeline and from the shutoff system and leads to a loss of containment of CO_2 and brine.	• Pressure, temperature, and flow sensors in real time • Field inspections	• Fence location and block direct access to the wellhead • Bollards and/or concrete barriers installed to protect installation • No populated area	• Trigger emergency isolation valves • SCADA notification to monitoring or operations staff • Follow protocol to shut down CO_2 delivery if the automatic shutoff device is not functional • If major emergency, call 911 • Designate an exclusion zone, and provide appropriate PPE for protection of onsite personnel • If there are injured personnel, call emergency team, and execute evacuation protocol • Clear the location and secure the perimeter. If possible, install containment devices around the location. • Notify 24-Hour Emergency Contact, State Police, and OC within 24 hours and propose action plan • Submit UIC Incident Report • Contact well control special team to execute blowout emergency plan that may include but is not limited to capping the well, secure location, drill relief well to kill injector, properly repair or abandon injection well. This plan would be discussed with OC • Evaluate environmental impact (soil, water, fauna, vegetation) • Execute remediation, and install monitoring system as needed	• Operations manager • Field superintendent • Project manager • Rig crew and service contractors • Remediation contractors • Well control specialist

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
23	Injection Period/ Post Injection Site Care Period	External impact – MW: The wellhead of the deep monitoring well is hit by a massive object that causes major damage leading to a LOC. Since the well is open to the formation pressure at the injection zone, formation fluids have the potential to flow and spill on the location.	• Pressure, temperature, and flow sensors in real time • Field inspections • Incremental leakage modeling to validate a lack of potential for fluid movement into the USDW.	• Fence location and block direct access to the wellhead • Bollards and/or concrete barriers installed to protect installation • No populated area • Lined pads • Reduced pressure in the monitoring well compared with the injector well on bottom	• SCADA alarms notification to operations staff • Designate an exclusion zone, and provide appropriate PPE for protection of onsite personnel • If major emergency, call 911 • If there are injured personnel, call emergency team, and execute evacuation protocol • Clear the location and secure the perimeter. If possible, install containment devices around the location. • Notify 24-Hour Emergency Contact, State Police, and OC within 24 hours and propose action plan • Submit UIC Incident Report • Contact well control special team to execute blowout emergency plan that may include, but is not limited to, capping the well, securing the location, drilling relief well to kill the injector, properly repairing, or abandoning the injection well. • Evaluate environmental impact (soil, water, fauna, vegetation) • Execute remediation, and install monitoring system as needed	• Operations manager • Field superintendent • Project manager • Rig crew and service contractors • Remediation contractors • Well control specialist

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
24	Injection Period	External impact – Infield pipeline:During injection, the CO_2 pipeline is hit causing major damage and LOC of the CO_2.	• Pressure, temperature, and flowmeter sensors in real time • Field inspections	• Buried pipe • Bollards and/or concrete barriers installed to protect aboveground piping at valve stations • Painting for visibility in varied weather conditions • Signage along right of way as needed • Pipeline is part of One Call system Fencing	• Trigger emergency isolation valves • SCADA alarms notification to operations staff • If major emergency, call 911 • If there are injured personnel, call emergency team, and execute evacuation protocol • Designate an exclusion zone, and provide appropriate PPE for protection of onsite personnel • Verify CO_2 flow was shut off by the system or start protocol to stop flow • Notify 24-Hour Emergency Contact and if necessary, State Police, and OC within 24 hours and propose action plan • Clear the location and secure the perimeter. If possible, install containment devices around the location • Evaluate environmental impact (soil, water, fauna, vegetation) • Notify OC and propose action plan • Execute remediation, and install monitoring system as needed • Notify Emergency Services within 15 min (WVC 15-5C)	• Operations manager • Field superintendent • Remediation contractors • Emergency teams • Plant manager/contact
25	Injection Period	Monitoring Equipment Failure or Malfunction: Failure of the monitoring system/ alarm devices that lead to over pressurization of the system or reservoir beyond the design limits, causing fracturing of the reservoir, leaks or failure on equipment and tubulars, and damage of the facilities.	• Real-time pressure monitoring system and redundancy • Field inspections	• Preventive maintenance • Periodic inspections	• Trigger emergency isolation valves • SCADA alarms notification to operations staff • Follow protocol to shut down CO_2 delivery if the automatic shutoff device is not functional • If major emergency, call 911 • If there are injured personnel, call emergency team, and execute evacuation protocol • Designate an exclusion zone, and provide appropriate PPE for protection of onsite personnel • Notify 24-Hour Emergency Contact, State Police, and OC within 24 hours and propose action plan • Submit UIC Incident Report • Assess mechanical integrity of the system, and propose repair actions if needed • Assess any potential environmental impact • Repair or replace instrumentation. Calibrate equipment.	• Operations manager • Field superintendent • Project manager • Remediation contractors • Emergency teams • Geologist • Reservoir engineers • Monitoring staff

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
					• Review monitoring records, and if needed, perform an injectivity test or falloff test to evaluate reservoir	
26	Injection Period/ Post Injection Site Care Period	Injection or Monitoring Equipment Failure: Failure of surface injection or monitoring equipment including injection pumps, valves, gauges, meters, sensors, electrical, or other equipment results in potentially unsafe operating conditions and requires an emergency response at the site.	• Real-time monitoring system and redundancy • Field inspections • Routine inspection/testing of emergency alert systems, monitoring systems and controls systems	• Preventive maintenance • Periodic inspections	• Trigger emergency isolation valves • SCADA alarms notification to operations staff • Follow protocol to shut down CO_2 delivery if the automatic shutoff device is not functional• If major emergency, call 911 • If there are injured personnel, call emergency team, and execute evacuation protocol • Designate an exclusion zone, and provide appropriate PPE for protection of onsite personnel • Notify 24-Hour Emergency Contact and if USDW impacted, State Police and OC within 24 hours and propose action plan • Submit UIC Incident Report • Assess mechanical integrity of the system, and propose repair actions if needed • Assess any potential environmental impact • Perform Lockout/Tagout (LOTO) for defective equipment until it is properly replaced • Repair or replace instrumentation. Calibrate equipment. • If the assessment allows resuming	• Operations manager • Field superintendent • Project manager • Remediation contractors • Emergency teams • Geologist • Reservoir engineers • Monitoring staff

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
					injection safely, discuss plan with the OC and get approval	
27	Injection Period/ Post Injection Site Care Period	Injection or Monitoring Equipment Failure:Malfunction of subsurface injection/monitoring well subsurface equipment including gauges, fiber, cables, or capillary string, requiring an emergency response at the site.	• Real-time monitoring system and redundancy • Field inspections • Routine inspection/testing of emergency alert systems, monitoring systems and controls systems.	• Preventive maintenance • Periodic inspections	• SCADA alarms notification to operations staff • If major emergency, call 911 • If there are injured personnel, call emergency team, and execute evacuation protocol • Notify 24-Hour Emergency Contact and if USDW impacted, State Police and OC within 24 hours and propose action plan • Submit UIC Incident Report • Assess mechanical integrity of the system, and propose repair actions if needed • Assess any potential environmental impact • If the assessment allows resuming injection safely, discuss plan with the OC and get approval • Repair or replace instrumentation. Calibrate equipment. • Review monitoring records, and if needed, perform an injectivity test or falloff test to evaluate reservoir	• Operations manager • Field superintendent • Project manager • Remediation contractors • Emergency teams • Geologist • Reservoir engineers • Monitoring staff

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
28	Injection Period	Injection or Monitoring Equipment Failure: A large pressure drop in the CO_2 stream results in low temperatures that could cause harm to personnel or damage/brittleness in materials (e.g., carbon steel and elastomers).	• Real time monitoring system of the CO_2 injection stream	• Use of materials that are rated for low temperatures • Controlled CO_2 stream composition	• Trigger emergency isolation valves • SCADA alarms notification to operations staff • Follow protocol to shut down CO2 delivery if the automatic shutoff device is not functional • If major emergency, call 911 • If there are injured personnel, call emergency team, and execute evacuation protocol • Designate an exclusion zone, and provide appropriate PPE for protection of onsite personnel • Notify 24-Hour Emergency Contact and if USDW impacted, State Police and OC within 24 hours and propose action plan • Submit UIC Incident Report • Assess mechanical integrity of the system, and propose repair actions if needed • Assess any potential environmental impact, and propose remedial action with the OC, if needed • If the assessment allows resuming injection safely, discuss plan with the OC and obtain approval • Repair or replace any damaged equipment and recalibrate • Review monitoring records and, if needed, adjust CO_2 accordingly	• Operations manager • Field superintendent • Plant manager • Emergency teams

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
29	Construction/ Injection Period/ Post Injection Site Care Period	Other Major Natural Disaster: Natural disaster that limits or endangers the normal operation of the Hub.	• Weather monitoring	• Project safety program • Condition/atmospheric monitoring. • Emergency shutdown valves	• SCADA alarms notification to operations staff • If major emergency, call 911 • If there is injured personnel or property damage, call emergency team, and execute evacuation protocol and secure location • Follow protocol to stop injection • Notify 24-Hour Emergency Contact and if USDW impacted, State Police and OC within 24 hours and propose action plan • Submit UIC Incident Report • Assess mechanical integrity of the system • Assess any potential environmental impact • If the assessment allows resuming injection safely, increase surveillance to validate effectiveness of the actions	• Operations manager • Field superintendent • Project manager • Remediation contractors • Emergency teams • Geologist • Reservoir engineers • Monitoring staff
30	Injection Period	Accidents or Unplanned Event:Loss of electricity causing injection to cease.	• Field inspections	• PLC with Uninterrupted Power Supply (UPS) • "Fail-Closed" shutdown valves • Consider backfeed to redundant generation sources • Install industry standard weather mitigation on distribution lines	• SCADA alarms notification to operations staff • PLC/UPS programmed to initiate a closure of shutdown valves in fail safe position (Fail-Closed) • PLC/UPS will continue to monitor the shutdown and report back to the SCADA system for personnel • If necessary, designate an exclusion zone, and provide appropriate PPE for protection of onsite personnel • If major emergency, call 911 • Verify CO_2 flow was shut off by the system or start manual protocol to stop flow, visual inspection, and manually close valves. • Notify 24-Hour Emergency Contact and if USDW impacted, State Police and OC within 24 hours and propose action plan • Submit UIC Incident Report • Notify OC of start-up procedure.	• Operations manager • Field superintendent • Project manager
31	Post-injection period	Unauthorized access/activity: Unauthorized activity onsite	• Field personnel logs	• Fencing around well sites • Security in place	• Report any incidents to local Sheriff's office • Submit UIC Incident Report	• Field superintendent • Company man

Appendix B: Emergency Contact List

Live Oak CCS Hub, Iberville and West Baton Rouge Parishes, Louisiana
Updated 5/17/2024

Facility Contacts	Phone Number
24-Hour Emergency Contact During Construction: Director Engineering – Ryan Choquette	Claimed as PBI
24-Hour Emergency Contact During Operation and Post-Injection: Operations Manager	TBD
Environmental Services Contractor	TBD
Local Agencies	
EMERGENCY - Local Emergency Responders	911
Iberville Parish Office of Emergency Management	225-687-5140
Iberville Parish Sheriff	225-687-5100
Iberville Parish Volunteer Fire Department	225-642-9980
West Baton Rouge Parish Office of Emergency Management	225-346-1577
West Baton Rouge Parish Sheriff	225-343-9234
West Baton Rouge Parish Fire Department	225-346-5676
State Agencies	
OC Emergency Reporting (24-Hour)	225-342-5155
Louisiana State Police	877-925-6595
Louisiana State Geological Survey	225-578-5320
Federal Agencies	
National Response Center (24 hours)	800-424-8802