Longleaf CCS Hub

Longleaf CCS, LLC

Emergency and Remedial Response Plan

40 CFR 146.94 (a)

Facility Information

Facility Name: Longleaf CCS Hub

Facility Contact: Longleaf CCS, LLC
14302 FNB Parkway
Omaha, NE 68154

Well Locations: Mobile County, Alabama
LL#1: Latitude: 31.071303° N
Longitude: -88.094703° W
LL#2: Latitude: 31.070774° N
Longitude: -88.074523° W
LL#3: Latitude: 31.0447129° N
Longitude: -88.0736318° W
LL#4: Latitude: 31.0569516° N
Longitude: -88.1047433° W

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List of Acronyms/Abbreviations

AoR	Area of Review
CCS	Carbon capture and storage
CO_2	Carbon dioxide
CMG	Computer Modelling Group
DOE	Department of Energy
DAS	Distributed Acoustic Sensing
DTS	Distributed Temperature Sensing
EPA	Environmental Protection Agency
ERRP	Emergency and Remedial Response
ft	Feet
LL	Longleaf
MIT	Mechanical Integrity Test
MMcf/d	Million cubic feet/day
mg/l	Milligrams per liter
mt	Metric tons
Mt	Millions of metric tons
mt/d	Metric tons per day
mt/y	Metric tons per day
MT/y	Millions of metric tons per year
PISC	Post-Injection Site Care
PNC	Pulsed Neutron Capture Log
psi	Pounds per square inch
psi/ft	Pounds per square inch per foot
SS	Sub-Sea
TVD	True Vertical Depth
UIC	Underground Injection Control
USDW	Underground Source of Drinking Water

A. Introduction

The purpose of this plan is to meet the requirements of 40 CFR 146.94 under the UIC Class VI Permit Guidelines. This ***Emergency and Remedial Response Plan*** (***ERRP***) covers the four proposed injection wells at the Longleaf CCS Hub in Mobile County, Alabama: LL#1, LL#2, LL#3, and LL#4. The ***ERRP*** outlines the actions that Longleaf CCS, LLC will take to address the unexpected movement of injection fluid or formation fluid in such a way as to endanger an underground source of drinking water (USDW) during the construction, operation, and post-injection site care (PISC) periods.

B. Local Resources and Infrastructure

The Longleaf CCS Hub AoR as described in the ***Area of Review and Corrective Action Plan*** covers an approximately 26 mi^2 area in northern Mobile County, as illustrated in **Figure 1** below. Overall, the land surface is sparsely populated and rural. Resources in the vicinity of the Longleaf CCS Hub that may be affected as a result of an emergency event in the project area include:

- **Citronelle Formation (Plio-Pleistocene)** – shallowest USDW source
- **Miocene series** – primary water source in northern Mobile County
- **Chickasawhay Formation (Upper Oligocene)** – the lowermost potential USDW
- **Surface bodies of water** – Cedar Creek, North Fork Cedar Creek, Bush Coon Creek, Indian Grave Creek, Conrad Creek, Grady Hall Creek, Bull Branch, Broad Branch, Boggy Branch, Spring Branch, and one small pond (unnamed).

There is limited existing infrastructure within the Longleaf CCS Hub project area. All land parcels within the Longleaf CCS Hub are classified as residential, with some containing residential buildings, while the rest are vacant. Other infrastructure within the project AoR are domestic water supply wells. The location of land parcels with residential buildings, domestic water supply wells, and vacant parcels are illustrated in **Figure 1**, with the Longleaf CCS Hub AoR shown for reference.

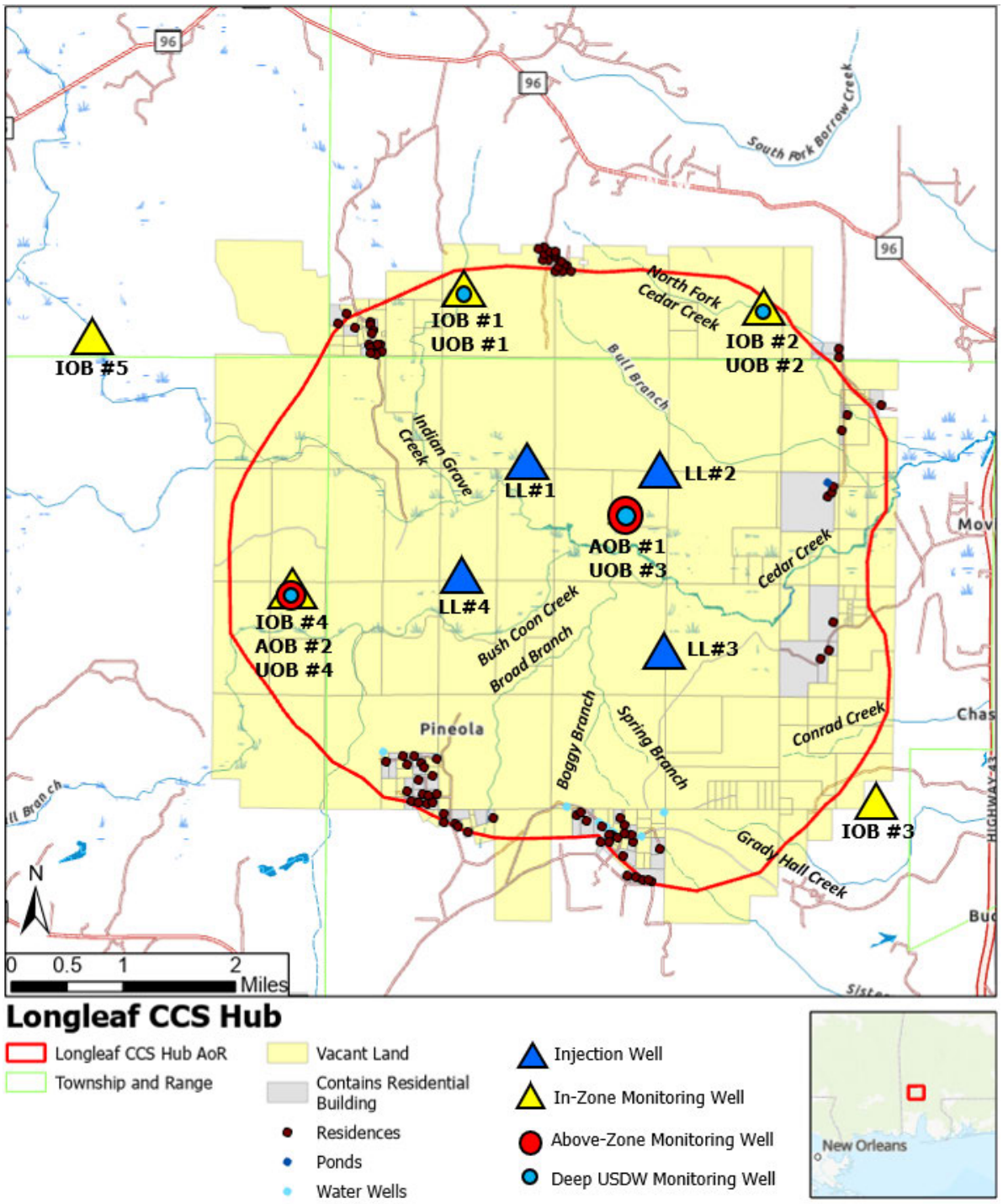

Figure 1. Map of the Site Resources and Infrastructure.

C. Potential Risk Scenarios

Several scenarios could trigger an emergency response. Events that would trigger emergency responses include incidents that could cause personal injury, that could lead to contamination of the USDW, or that could result in property damage. These events may occur during the construction, injection, or post-injection site care period. Possible major or moderate events requiring an emergency response for each stage of project development at the Longleaf CCS are outlined in **Table 1**.

Table 1. Risk Scenario Matrix for Longleaf CCS Hub

Risk Scenario	Construction Period	Injection Period	Post-Injection Site Care Period	Severity Range	Appendix A Item Number
Fluid communication between formations while drilling	x			Moderate to Major	1-3
Fluid leakage into 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	4-17
External impact to project wellheads or pipelines		x	x	Moderate to Major	20-22
Loss of mechanical integrity (injection or monitoring well)	x	x	x	Minor to Major	4-7
Migration of CO_2 outside of defined AoR		x	x	Minor to Major	18-19
Injection or monitoring equipment failure/malfunction		x	x	Minor to Moderate	23-26
Induced seismicity		x	x	Minor to Major	27-28
Natural disaster (hurricane, earthquake, tornado, lightning, flood)		x	x	Minor to Major	29-30
Accident or unplanned event (e.g., electrical outage causing injection to stop)		x		Minor	31

The risk scenarios outlined in **Table 1** and response actions for these risk scenarios are summarized in ***Appendix A***. The appropriate response will depend on the nature of the emergency and the severity of the event. Emergency severity is categorized into minor, moderate, and major events, as defined in **Table 2**, and the range of severity for each risk scenario in **Table 1** is based on these criteria. A formal risk assessment will be conducted prior to requesting permission to operate, with a formal risk assessment report provided to the UIC Program Director.

Table 2. Degrees of Risk for Emergency Events.

Emergency Severity	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.
Moderate 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.

D. 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 following actions will be taken by Longleaf CCS, LLC if, through monitoring activities, there is evidence that a major or moderate emergency has occurred that may pose a risk to a USDW or community infrastructure:

1. Initiate the emergency shutdown plan for the injection well.
2. Take all steps reasonably necessary to identify and characterize the suspected cause of the event.
3. Notify the facility's 24-Hour Emergency Contact of the emergency within 24 hours followed by a contact with the UIC Program Director.
4. 24-Hour Emergency Contact will contact the response personnel listed in the column headed "Response Personnel" in ***Appendix A***, as needed.
5. Implement the applicable portions of the approved ***ERRP***.

Where the phrase "initiate the emergency shutdown plan" is used, the following protocol will be employed: Longleaf CCS, LLC will endeavor to immediately cease injection; however, in some circumstances, Longleaf CCS, LLC will, in consultation with

the UIC Program Director, determine whether gradual cessation of injection (using the parameters set forth in ***Appendix A*** of this plan) is appropriate.

The specific potential risk scenarios identified in ***Part C*** and detailed in ***Appendix A*** are conceptual, and the specific response plans may be amended in coordination with the UIC Program Director based on health, safety, and environmental circumstances specific to each event. In the event of an emergency requiring outside assistance, the lead project contact will notify the 24-Hour Emergency Contact identified in ***Appendix B*** of this ***ERRP*** as soon as possible after requesting outside assistance from local emergency responders. Other notifications will be determined based on the type of emergency and notification requirements identified in ***Appendix A***.

E. Response Personnel and Equipment

Site personnel, project personnel, and local authorities will be relied upon to implement this ***ERRP***. The City of Citronelle and the communities of Movico and Mt. Vernon are the closest population centers to the Longleaf CCS Hub. Therefore, both city and county emergency responders (as well as state agencies) may need to be notified in the event of an emergency. Please refer to ***Appendix B*** for an emergency contact list that will be updated annually at a minimum.

Equipment needed in the event of an emergency and remedial response will vary depending on the triggering emergency event and is specified for each potential risk scenario in Appendix A. 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, Longleaf CCS, LLC will be responsible for its procurement.

F. Emergency Communications Plan

In the event of an emergency requiring outside assistance, the lead project contact will notify the 24-Hour Emergency Contact identified in ***Appendix B*** of this ***ERRP*** as soon as possible after requesting outside assistance from local emergency responders.

Longleaf 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 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.

Longleaf 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), Longleaf CCS, LLC will provide periodic updates on the progress of the response action(s).

Longleaf CCS, LLC will also communicate with entities who may need to be informed about or act 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).

G. Plan Review

This ***ERRP*** shall be periodically reviewed as follows:

- At least once every five (5) years following its approval by the permitting agency.
- After an area of review (AoR) reevaluation.
- Following any significant changes to the injection process or the injection facility, or an emergency event; and
- At least annually for the Emergency Contact List in ***Appendix B*** of this ***ERRP***.

An amended ***ERRP*** should be submitted to the UIC Program Director within 1 year of an AoR reevaluation, following any significant changes to the facility, or when required by the UIC Program Director. Amendments must be approved by the UIC Program Director and incorporated into the permit and are subject to permit modification requirements. If the review indicates that no amendments to the ***ERRP*** are necessary, Longleaf CCS, LLC will provide the UIC Program Director 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 (40 CFR 144.41).

H. Staff Training and Exercise Procedures

Longleaf CCS, LLC will integrate the ***ERRP*** into its existing operating procedures and training protocols. Periodic training will be provided, not less than annually, to construction personnel, well operators, project safety and environmental personnel, the operations manager, and corporate communications. The training plan will document that the necessary personnel have been trained and possess the required skills to perform their relevant emergency response activities described in the ***ERRP***.

I. Communications with Adjacent Landowners and Emergency Response Personnel

Prior to the start of CO_2 injection operations, Longleaf CCS, LLC will attempt to promptly communicate with landowners living near each injection well site as identified on **Figure 2** to provide information of the nature of the operations, potential risks, and appropriate response approaches under various emergency scenarios. Longleaf CCS, LLC's point of contact for any landowner or stakeholder concerns is listed in **Table 3**.

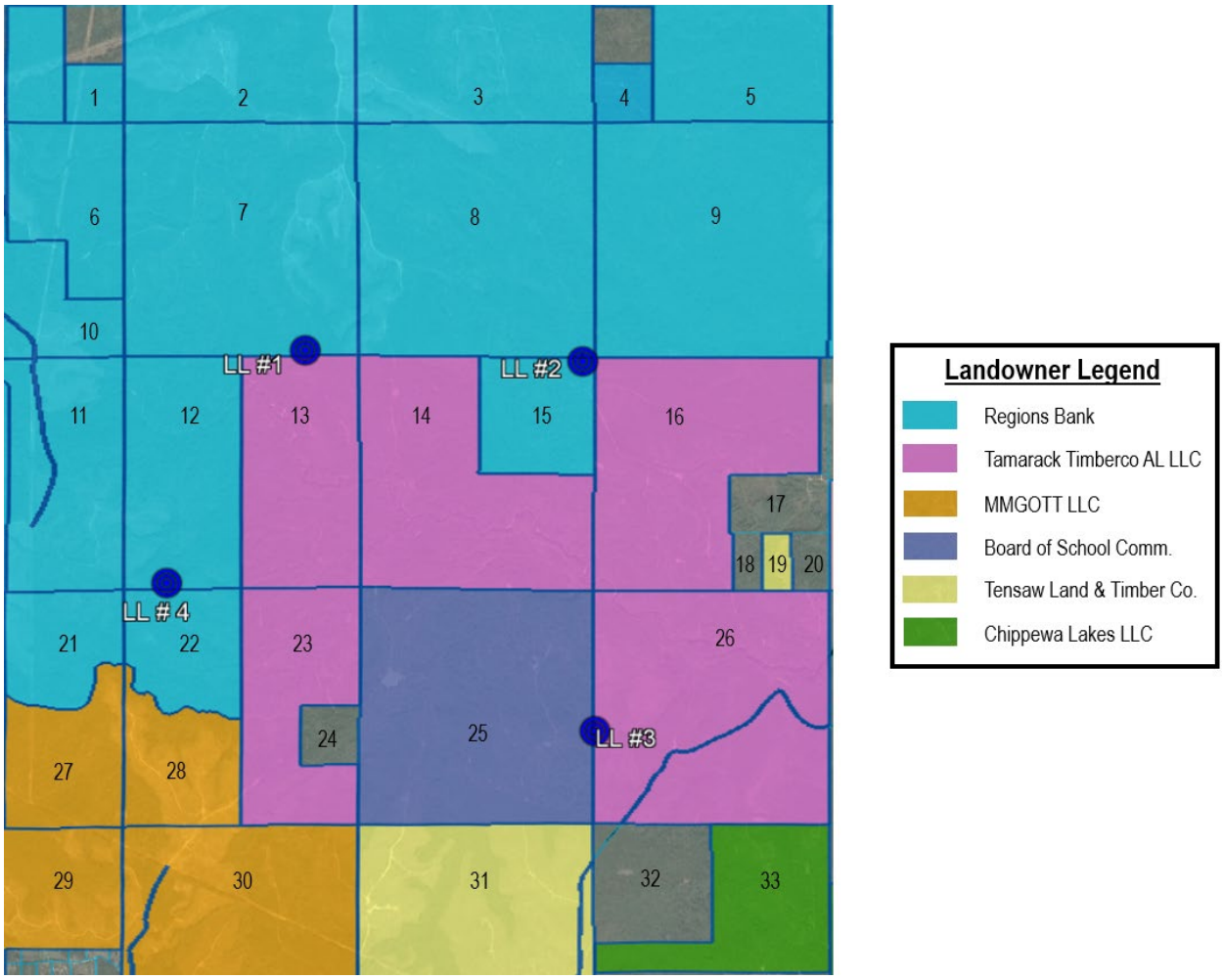

Figure 2. Aerial map provided by Longleaf CCS, LLC identifying the land parcels and ownership around the proposed injection wells. Landowner details are provided in Table 3.

Table 3. Details of the landowners identified by Longleaf CCS, LLC shown in Figure 2.

Tract Number	Parcel ID	S – T – R	Owner Name	Address
1	0209310000017	31-2N-1W		
2	0209320000005	32-2N-1W		
3	0208330000007	33-2N-1W		
4	0208340000003	34-2N-1W		
5	0208340000001	34-2N-1W		
6	0903060000002	06-1N-1W		
7	0903050000001	05-1N-1W		
8	0902040000001	04-1N-1W		
9	0902030000001	03-1N-1W		
10	0903060000002	06-1N-1W		
11	0903070000001	07-1N-1W		
12	0903080000002	08-1N-1W		
13	0903080000001	08-1N-1W		
14	0902090000002	09-1N-1W		
15	0902090000001	09-1N-1W		
16	0902100000001	10-1N-1W		
17	0902100000002	10-1N-1W		
18	0902100000003	10-1N-1W		

Tract Number	Parcel ID	S – T – R	Owner Name	Address
19	0902100000004	10-1N-1W		
20	0902100000005	10-1N-1W		
21	0904180000001	18-1N-1W		
22	0904170000002	17-1N-1W		
23	0904170000001	17-1N-1W		
24	0904170000003	17-1N-1W		
25	0905160000001	16-1N-1W		
26	0905150000001	15-1N-1W		
27	0904180000001	18-1N-1W		
28	0904170000002	17-1N-1W		
29	0904190000001	19-1N-1W		
30	0904200000001	20-1N-1W		
31	0905210000001	21-1N-1W		
32	0905220000002	22-1N-1W		
33	0905220000001	22-1N-1W		

Appendix A. Emergency Remedial and Response Risk Scenarios

Longleaf CCS Hub
Mobile County, Alabama

Table 1. Emergency Remedial and Response Risk Scenarios

	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	<u>Drilling:</u> * Stop operation * Close BOP * Clear floor and secure area * Execute well control procedure * Evaluate drilling parameters to identify root cause * Notify 24-Hour Emergency Contact and UIC Program Director and propose an action plan based on the finding * Continue operations <u>Completion:</u> * Stop operations * Close BOP * Clear floor and secure area * Execute well control procedure * Notify 24-Hour Emergency Contact and UIC Program Director and propose remediation plans. * Continue operations	* Project manager * Rig crew * Rig manager * Field superintendent
2	Construction Period	***Fluid Leakage - Drilling operations:*** Failure of surface casing completion to protect USDW while drilling resulting in cross flow of brine between formations resulting in fluid losses into the underground source of drinking water (USDW).	* Pressure sensors * Cement bond log (CBL)	* Pressure sensors * USDW will be covered with the surface casing * Casing test after cementing surface casing to check integrity * CBL to check cement bonding	* 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. * Notify 24-Hour Emergency Contact and UIC Program	* Project manager * Rig crew * Rig manager * Field superintendent

					Director and propose remediation plans.	
	PROJECT PHASE	**RISK SCENARIO**	**MONITORING EQUIPMENT**	**CONTROL IN PLACE**	**RESPONSE ACTION**	**RESPONSE PERSONNEL**
3	Construction Period	***Fluid Leakage - Drilling through USDW:*** Improper well control during the drilling of one or more monitoring or injection wells, the drilling fluid weight exceeds the aquifer reservoir pressure, and the drilling fluid migrates into the pores and contaminates a USDW.	* Flow sensor * Pressure sensor *Mud weight control	* Well control training * Overbalance mud program	<u>Drilling:</u> * Stop operation * Close BOP * Clear floor and secure area * Execute well control procedure * Evaluate drilling parameters to identify root cause * Notify 24-Hour Emergency Contact and UIC Program Director and propose remediation plans. *Implement corrective actions * Continue operations	* Project manager * Rig crew * Rig manager * Field superintendent
4	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 annular casing 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 better * 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 UIC Program Director and propose an action plan based on the finding * Schedule well service to repair tubing	* Operations manager * Field superintendent * Project manager

	PROJECT PHASE	RISK SCENARIO	MONITORING EQUIPMENT	CONTROL IN PLACE	RESPONSE ACTION	RESPONSE PERSONNEL
5	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 better * 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 * Monitoring 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 UIC Program Director 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 DH contractors
6	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	* 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 * 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 gets affected, discuss remediation options with the UIC Program Director * Notify UIC Program Director and propose an action plan based	* Operations manager * Field superintendent * Project manager * Rig crew and DH contractors * Remediation contractors

			* USDW water monitoring		on the finding and location of the leak * Schedule well service to repair the casing	
	PROJECT PHASE	**RISK SCENARIO**	**MONITORING EQUIPMENT**	**CONTROL IN PLACE**	**RESPONSE ACTION**	**RESPONSE PERSONNEL**
7	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 * Monitoring 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 gets affected, discuss remediation options with the UIC Program Director * Notify UIC Program Director and propose an action plan based on the findings and the location of the leak. * Schedule well service to repair the casing	* Operations manager * Field superintendent * Project manager * Rig crew and DH contractors * Remediation contractors
8	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.	* Time-lapse vertical seismic profile survey * USDW water sampling	* 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 monitoring 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 regulator and propose plan to repair the well, delineate the area, and identify potential resources affected * Discuss specific remediation actions and monitoring plans * Execute program, monitor, and evaluate efficacy	* Operations manager * Field superintendent * Project manager * Rig crew and DH contractors * Remediation contractors

	PROJECT PHASE	RISK SCENARIO	MONITORING EQUIPMENT	CONTROL IN PLACE	RESPONSE ACTION	RESPONSE PERSONNEL
9	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 * Time-lapse vertical seismic profile survey * Pulsed-neutron log in injector and monitoring wells	* Injection is limited to 90% of frac gradient * Extensive characterization of the rocks shows good sealing capacity * If the confining zone above the Paluxy fails, the Selma Group will act as a buffer formation before CO_2 or brines are able to reach the USDW	* Notify 24-Hour Emergency Contact * Assess root cause by reviewing monitoring data * Notify UIC Program Director * If necessary, follow protocol to stop injection. * 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 gets affected, discuss with UIC Program Director 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 UIC Program Director	* Operations manager * Field superintendent * Geologist * Reservoir engineer * Project manager * Remediation contractors
10	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 * Time-lapse seismic profile survey * Pulsed-neutron log in injector and monitoring 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 Paluxy fails, the Selma Group will act as a buffer formation before CO_2 or	* 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 * Notify 24-Hour Emergency Contact * Assess root cause by reviewing monitoring data	* Operations manager * Field superintendent * Monitoring staff * Geologist * Reservoir engineer * Project manager * Remediation contractors

				brines are able to reach the USDW * Microfracture test prior to receiving authorization to operate, confirm formation breakdown pressure.	* If required, conduct geophysical survey to delineate potential leakage pathway * Evaluate if there is a movement of CO_2 or brines to USDW. * Notify UIC Program Director 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 UIC Program Director	
	PROJECT PHASE	**RISK SCENARIO**	**MONITORING EQUIPMENT**	**CONTROL IN PLACE**	**RESPONSE ACTION**	**RESPONSE PERSONNEL**
11	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 * Follow protocol to shut down CO_2 delivery * If there is injured personnel, call emergency team, and execute evacuation protocol * Notify 24-Hour Emergency Contact * Clear location and secure the perimeter. If possible, install containment devices around the location. * Evaluate environmental impact (soil, water, fauna, vegetation),	* Operations manager *Field superintendent *Project manager *Plant manager *Remediation contractors

					* Assess mechanical integrity of the system * Notify UIC Program Director and propose repair actions * Repair or replace equipment	
	PROJECT PHASE	**RISK SCENARIO**	**MONITORING EQUIPMENT**	**CONTROL IN PLACE**	**RESPONSE ACTION**	**RESPONSE PERSONNEL**
12	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 there is injured personnel, call emergency team, and execute evacuation protocol * Notify 24-Hour Emergency Contact * Clear location and secure the perimeter. I * Evaluate environmental impact * Assess mechanical integrity of the system * Notify UIC Program Director and propose repair actions * Repair or replace equipment	* Operations manager *Field superintendent *Plant manager *Remediation contractors *Emergency teams
13	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.	* Trigger Emergency isolation valves * SCADA alarms notification to operations staff * Follow protocol to shut down CO_2 delivery * If there is injured personnel, call emergency team, and execute evacuation protocol * Notify 24-Hour Emergency Contact to activate emergency plan, reverse 9-1-1 protocol for residents or occupants in proximity to occurrence.	* Operations manager *Field superintendent *Plant manager *Remediation contractors

				* Witches hat (cone strainer) filters can be used to filter out large pieces of debris on startup	* 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 * Notify UIC Program Director and propose repair actions * Repair or replace equipment	
	PROJECT PHASE	**RISK SCENARIO**	**MONITORING EQUIPMENT**	**CONTROL IN PLACE**	**RESPONSE ACTION**	**RESPONSE PERSONNEL**
14	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 whenever 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 there is injured personnel, call emergency team, and execute evacuation protocol * Notify 24-Hour Emergency Contact * Clear the location and secure the perimeter. If possible, install containment devices around the location. *Assess mechanical integrity of the pipelines or flowlines * Notify UIC Program Director and propose action plan * Evaluate environmental impact (soil, water, fauna, vegetation), and present remediation plan to the UIC Program Director for approval	* Operations manager * Field superintendent * Project manager *Remediation contractors *Emergency teams

					* Execute remediation, and install additional monitoring system as needed	
	PROJECT PHASE	**RISK SCENARIO**	**MONITORING EQUIPMENT**	**CONTROL IN PLACE**	**RESPONSE ACTION**	**RESPONSE PERSONNEL**
15	Injection Period	***Fluid Leakage – Surface Infrastructure:*** Failure of CO_2 transport flowlines from the CO_2 capture system to Longleaf CCS Hub CO_2 Injection wellhead.	* 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 * Initiate evacuation plan * Notify 24-Hour Emergency Contact * Transmission line and/or flowline failure will be inspected to determine the root cause of the failure * Notify UIC Program Director and propose action plan * 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
16	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	* CO_2 leak sensors on the wellhead * DTS fiber real time alongside the casing * USDW water monitoring * Pulsed-neutron logs (PNL) to be	* 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	* 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	* Operations manager * Field superintendent * Project manager * Rig crew and DH contractors * Remediation contractors

		the tubulars trying to expand or contract, and it can lead to microannulus effects, resulting in fugitive movement of brines/CO_2.	run for external integrity * CBL/Ultra-sonic logging * Pressure gauges at surface * Flow rate monitoring	* USDW covered as second barrier with surface casing and surface cement sheet * New casing installed, 13CR or better.	* Evaluate if there is a movement of CO_2 or brines to USDW. * Notify UIC Program Director and discuss action plan to repair the well or P&A based on the findings of the assessment	
	PROJECT PHASE	**RISK SCENARIO**	**MONITORING EQUIPMENT**	**CONTROL IN PLACE**	**RESPONSE ACTION**	**RESPONSE PERSONNEL**
17	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 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 microannulus 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. * Monitoring 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. * Notify UIC Program Director and discuss action plan to repair the well or P&A based on the findings of the assessment	* Operations manager * Field superintendent * Project manager * Rig crew and DH contractors * Remediation contractors
18	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.	* Time-lapse vertical seismic profile surveys * Pulsed-neutron logs in monitoring wells * Pressure and temperature gauges real time in monitoring 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	<u>Injection period:</u> * 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 UIC Program Director, propose action plan and request to keep injection process while AoR is reviewed, if the data	* Operations manager * Field superintendent * Geologist * Reservoir engineers * Project manager

					show that CO_2 will stay in the secured pore space. * Perform logging in monitoring 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 UIC Program Director * Present AoR review to UIC Program Director for approval and adjust monitoring plan <u>Post Injection Site Care Period:</u> * SCADA alarms notification to monitoring personnel * Notify 24-Hour Emergency Contact * Review monitoring data and trends, compare with the simulation * Notify UIC Program Director and propose action plan * 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 UIC Program Director	
	PROJECT PHASE	**RISK SCENARIO**	**MONITORING EQUIPMENT**	**CONTROL IN PLACE**	**RESPONSE ACTION**	**RESPONSE PERSONNEL**
19	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 * Time-lapse vertical seismic profile survey (AoR review periods) * 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	<u>Injection period:</u> * 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. * Notify UIC Program Director 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 * Perform logging in monitoring 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 UIC Program Director * Present AoR review to UIC Program Director for approval and adjust monitoring plan	* Operations manager * Field superintendent * Monitoring staff * Geologist * Reservoir engineers * Project manager * Remediation contractors

					Post Injection Site Care Period: * Identification by monitoring staff * Notify 24-Hour Emergency Contact * Review monitoring data and trends and compare with simulations * Notify UIC Program Director and propose action plan * 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 * Evaluate if there is a movement of CO_2 or brines to USDW. In the remote event that USDW gets affected, discuss remediation options with the UIC Program Director	
	PROJECT PHASE	**RISK SCENARIO**	**MONITORING EQUIPMENT**	**CONTROL IN PLACE**	**RESPONSE ACTION**	**RESPONSE PERSONNEL**
20	Injection Period	***External impact – UIC Well:*** During injection, the wellhead is hit by a massive object that causes major damages to the equipment. The well gets disconnected from the pipeline and from the shutoff system	* 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	* Operations manager * Field superintendent * Project manager * Rig crew and DH contractors * Remediation contractors

		and leads to a loss of containment of CO_2 and brine.			* Designate an exclusion zone, and provide appropriate PPE for protection of onsite personnel * If there is injured personnel, call emergency team, and execute evacuation protocol * Notify 24-Hour Emergency Contact * Clear the location and secure the perimeter. If possible, install containment devices around the location. * 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 UIC Program Director * Evaluate environmental impact (soil, water, fauna, vegetation) * Notify UIC Program Director and propose action plan * Execute remediation, and install monitoring system as needed	* Well control specialist
	PROJECT PHASE	**RISK SCENARIO**	**MONITORING EQUIPMENT**	**CONTROL IN PLACE**	**RESPONSE ACTION**	**RESPONSE PERSONNEL**
21	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 damages leading to a LOC. Since the well is open to the formation pressure at the injection zone, formation fluids have the	* Pressure, temperature, and flow sensors in real time * Field inspections * Incremental leakage modeling to validate a lack	* Fence location and block direct access to the wellhead * Bollards and/or concrete barriers installed to protect installation * No populated area * Lined pads	* SCADA alarms notification to operations staff * Designate an exclusion zone, and provide appropriate PPE for protection of onsite personnel * If there is injured personnel, call emergency team, and execute evacuation protocol	* Operations manager * Field superintendent * Project manager * Rig crew and DH contractors * Remediation contractors * Well control specialist

		potential to flow and spill on the location.	of potential for fluid movement into the USDW.	* Reduced pressure in the monitoring well compared with the injector well on bottom	* Notify 24-Hour Emergency Contact * Clear the location and secure the perimeter. If possible, install containment devices around the location. * 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) * Notify UIC Program Director and propose action plan * Execute remediation, and install monitoring system as needed	
22	Injection Period	***External impact – Pipeline:*** During injection, the CO_2 pipeline is hit causing major damages and LOC of the CO_2.	* Pressure, temperature, and flowmeter sensors in real time * Field inspections * Bollards and/or concrete barriers installed to protect aboveground piping at valve stations * Appropriate warning signage/painting * Appropriate fencing	* 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	* Trigger emergency isolation valves * SCADA alarms notification to operations staff * If there is 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 * Clear the location and secure the perimeter. If possible, install	* Operations manager * Field superintendent * Remediation contractors * Emergency teams * Plant manager/ contact

					containment devices around the location. * Evaluate environmental impact (soil, water, fauna, vegetation) * Notify UIC Program Director and propose action plan * Execute remediation, and install monitoring system as needed	
	PROJECT PHASE	**RISK SCENARIO**	**MONITORING EQUIPMENT**	**CONTROL IN PLACE**	**RESPONSE ACTION**	**RESPONSE PERSONNEL**
23	Injection Period	***Monitoring Equipment Failure or Malfunction:*** Failure on 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	* SCADA alarms notification to operations staff * 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 * Assess mechanical integrity of the system, and propose repair actions if needed * Assess any potential environmental impact * Notify UIC Program Director and propose action plan * 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
	PROJECT PHASE	**RISK SCENARIO**	**MONITORING EQUIPMENT**	**CONTROL IN PLACE**	**RESPONSE ACTION**	**RESPONSE PERSONNEL**
24	Injection Period/	***Injection or Monitoring Equipment Failure:***	* Real-time monitoring	* Preventive maintenance * Periodic inspections	* SCADA alarms notification to operations staff	* Operations manager * Field superintendent

	Post Injection Site Care Period	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.	system and redundancy * Field inspections * Routine inspection/testing of emergency alert systems, monitoring systems and controls systems.		* 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 * Assess mechanical integrity of the system, and propose repair actions if needed * Assess any potential environmental impact * Notify UIC Program Director and propose action plan * Perform Lockout/Tagout (LOTO) for defective equipment until it is properly replaced * Repair or replace instrumentation. Calibrate equipment. * If the assessment allows resuming injection safely, discuss plan with the UIC Program Director and get approval	* Project manager * Remediation contractors * Emergency teams * Geologist * Reservoir engineers * Monitoring staff
	PROJECT PHASE	**RISK SCENARIO**	**MONITORING EQUIPMENT**	**CONTROL IN PLACE**	**RESPONSE ACTION**	**RESPONSE PERSONNEL**
25	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	* Preventive maintenance * Periodic inspections	* SCADA alarms notification to operations staff * If there are injured personnel, call emergency team, and execute evacuation protocol * Notify 24-Hour Emergency Contact * Assess mechanical integrity of the system, and propose repair actions if needed	* Operations manager * Field superintendent * Project manager * Remediation contractors * Emergency teams * Geologist * Reservoir engineers * Monitoring staff

			systems and controls systems.		* Assess any potential environmental impact * Notify UIC Program Director and propose action plan * If the assessment allows resuming injection safely, discuss plan with the UIC Program Director 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	
26	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	* SCADA alarms notification to operations staff * 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 * Assess mechanical integrity of the system, and propose repair actions if needed * Assess any potential environmental impact, and propose remedial action with the UIC Program Director, if needed * If the assessment allows resuming injection safely, discuss plan with the UIC Program Director and obtain approval	* Operations manager *Field superintendent *Plant manager *Emergency teams

					* Repair or replace any damaged equipment and recalibrate * Review monitoring records and, if needed, adjust CO_2 accordingly	
	PROJECT PHASE	**RISK SCENARIO**	**MONITORING EQUIPMENT**	**CONTROL IN PLACE**	**RESPONSE ACTION**	**RESPONSE PERSONNEL**
27	Injection Period	***Induced Seismicity:*** Pressurization of the reservoir, during injection of CO_2, activates preexisting fault planes and creates a displacement that causes a seismic event. If it's a major event (>2.7 Richter), it could compromise the integrity of the wells, facilities, or pipeline.	* Geophones array to monitor induced seismicity * DAS fiber * Pulsed-neutron logs * CBL/Ultra-sonic logging	* A detailed geomechanical model was created to evaluate the storage complex * The region is seismically stable * Cased hole logging program	* SCADA alarms notification to operations staff * If there is injured personnel or property damages, call emergency team, and execute evacuation protocol and secure location * Notify 24-Hour Emergency Contact * Assess any potential environmental impact * Notify UIC Program Director and propose action plan, if needed * Define new injection parameters and get approval from the UIC Program Director * 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
	PROJECT PHASE	**RISK SCENARIO**	**MONITORING EQUIPMENT**	**CONTROL IN PLACE**	**RESPONSE ACTION**	**RESPONSE PERSONNEL**
28	Injection Period/ Post Injection Site Care Period	***Induced Seismicity:*** Other subsurface injection (e.g., saltwater disposal) causes pressure changes and induced seismicity at the Project Site or induced seismicity occurs at a nearby site that impacts the Project site.	* Geophones array to monitor induced seismicity * DAS fiber * Pressure gauges at surface * Pulsed-neutron logs	* Detailed geomechanical model was created to evaluate the storage complex * Cased hole logging program	* SCADA alarms notification to operations staff * If there is injured personnel or property damage, call emergency team, and execute evacuation protocol and secure location * Follow protocol to stop injection (injection period)	* Operations manager * Field superintendent * Project manager * Geologist * Monitoring staff * Remediation contractors

			* CBL/Ultra-sonic logging		* Notify 24-Hour Emergency Contact * Assess any potential environmental impact * Notify UIC Program Director and propose action plan, if needed * Review regional information as well as monitoring records to determine the origin of the event (natural or induced) * If the assessment allows resuming injection safely, increase surveillance to validate effectiveness of the actions (injection period)	
29	Injection Period/ Post Injection Site Care Period	***Major seismic event*** Natural seismicity causes LOC by opening transmissive features in the confining zone, resulting in release of CO_2 to a USDW, surface, or atmosphere.	* Geophones array to monitor induced seismicity * DAS fiber * Pulsed-neutron logs * CBL/Ultra-sonic logging	* The region is seismically stable * Cased hole logging program	* SCADA alarms notification to operations staff * If there is injured personnel or property damage, call emergency team, and execute evacuation protocol and secure location * Designate an exclusion zone, and provide appropriate PPE for protection of onsite personnel * Notify 24-Hour Emergency Contact * Assess any potential environmental impact * Notify UIC Program Director and propose action plan, if needed * If the assessment allows resuming injection safely, increase surveillance to validate effectiveness of the actions (injection period)	* Operations manager * Field superintendent * Project manager * Remediation contractors * Emergency teams * Geologist * Reservoir engineers * Monitoring staff
	PROJECT PHASE	**RISK SCENARIO**	**MONITORING EQUIPMENT**	**CONTROL IN PLACE**	**RESPONSE ACTION**	**RESPONSE PERSONNEL**

30	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 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 * Assess mechanical integrity of the system * Assess any potential environmental impact * Notify UIC Program Director and propose repair actions based on findings * 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
31	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 or generation sources *Install industry standard weather mitigation on distribution lines *Solar Back-up if required	* 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 * 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 manual protocol to stop flow, visual inspection, and manually close valves.	* Operations manager * Field superintendent * Project manager

					* Notify 24-Hour Emergency Contact * Notify UIC Program Director within 24-hours of shut-in * Notify UIC Program Director of start-up procedure.	

Appendix B. Emergency Contact List
Longleaf CCS Hub, Mobile County, Alabama
Updated 3/23/2023

Facility Contacts	Phone Number
24-Hour Emergency Contact During Construction: Project Manager – [redacted]	[redacted]
24-Hour Emergency Contact During Operation and Post-Injection: Operations Manager – TBD	TBD
Local Agencies	
Mt. Vernon Fire Department	251-829-6040
Mt. Vernon Police Department	251-829-6631 or 251-829-9966
Citronelle Fire & Rescue	251-866-9780 or 251-899-7973
Citronelle Police Department	251-866-2823 or 251-866-5527
Satsume Fire Department	251-675-1440
Saraland Fire Rescue Department	251-679-5506
Turnerville Volunteer Fire Department	251-866-9911
Mobile Fire-Rescue Department	251-208-7351
Mobile County Emergency Management	251-460-8000
Washington County Emergency Management Agency	251-847-2668
State Agencies	
Alabama Emergency Management Agency – 24-Hour State Warning Point	800-843-0699
Alabama Department of Environmental Management – Montgomery Field Office	334-260-2700
Geological Survey of Alabama	205-349-2852
Alabama Public Service Commission – Gas Pipeline Safety	334-242-5778
Federal Agencies	
National Response Center (NRC)	800-424-8802