# 10 EMERGENCY AND REMEDIAL RESPONSE PLAN

## 40 CFR 146.94(a)

## TULARE COUNTY CARBON STORAGE PROJECT (TCCSP)

### Facility Information

Facility (site) Name: Tulare County Carbon Storage Project (TCCSP)
Facility Operator: TCCSP, LLC.

Facility Contact: [redacted]

Project Location: [redacted], Tulare County, California

Injection Well Name and Coordinates:

| Well Name | Latitude | Longitude |
|---|---|---|
| TCCSP_INJ-1 | [redacted] | [redacted] |
| TCCSP_INJ-2 | [redacted] | [redacted] |

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## List of Acronyms/Abbreviations

| | |
|---|---|
| BOP | Blowout Preventor |
| CBL | Cement Bond Log |
| CCS | Carbon Capture and Storage |
| CFR | Code of Federal Regulations |
| CR | Chromium Tubing |
| DCS | Distributed Control System |
| DTS | Distributed Temperature Sensing |
| EPA | Environmental Protection Agency |
| LOC | Loss of Control |
| MIT | Mechanical Integrity Test |
| OSHA | Occupational Safety and Health Administration |
| PISC | Post-Injection Site Care |
| PLC | Programmable Logical Controllers |
| PPE | Personal Protective Equipment |
| SCADA | Supervisory Control and Data Acquisition |
| UIC | Underground Injection Control |
| UPS | Uninterpreted Power Supply |
| USDW | Underground Sources of Drinking Water |

## 10.1 Emergency and Remedial Response Plan Overview

The purpose of this **Emergency and Remedial Response Plan (ERRP)** is to meet the federal requirements of 40 CFR 146.94 under the UIC Class VI Permit Guidelines. This plan covers the two proposed injection wells at the Tulare County Carbon Storage Project (TCCSP) in Tulare County, California: TCCSP_INJ-1 and TCCSP_INJ-2. The **ERRP** outlines the actions that TCCSP, LLC. will take to address the unexpected movement of injection fluid or formation fluid if it endangers an underground source of drinking water (USDW) during the construction, operation, or **Post-Injection Site Care (PISC)** periods.

## 10.2 Local Resources and Infrastructure

The TCCSP Area of Review (AoR) as described in the **Area of Review and Corrective Action Plan** covers an approximately [redacted] area in Tulare County, California as illustrated in **Figure 10-1.** Overall, the land surface is comprised of [redacted] as defined by the National Land Cover Database [1]. Resources in the vicinity of the TCCSP that may be affected due to an emergency event within the project area include:

- [redacted] – Shallowest USDW zone
- [redacted] – Primary water source for the region that encompasses the AoR
- [redacted] – The lowermost USDW
- Creeks, streams, and other water bodies
- Agricultural land

Infrastructure in the vicinity of the TCCSP that that may be affected as a result of an emergency at the project site include:

- Project infrastructure – $CO_2$ capture and compression systems (outside project area of review), $CO_2$ pipeline (buried), $CO_2$ injection wells, in-zone monitoring wells, above-zone monitoring wells, monitoring, and distributed control system (DCS) equipment
- Potable water wells
- Residential properties
- Commercial properties
- Industrial properties
- Recreational properties
- Protected areas, including the [redacted]

The location of the TCCSP along with infrastructure, oil and gas wells, and water supply wells, is illustrated in **Figure 10-1** and **Figure 10-2**, with the TCCSP AoR shown for reference.

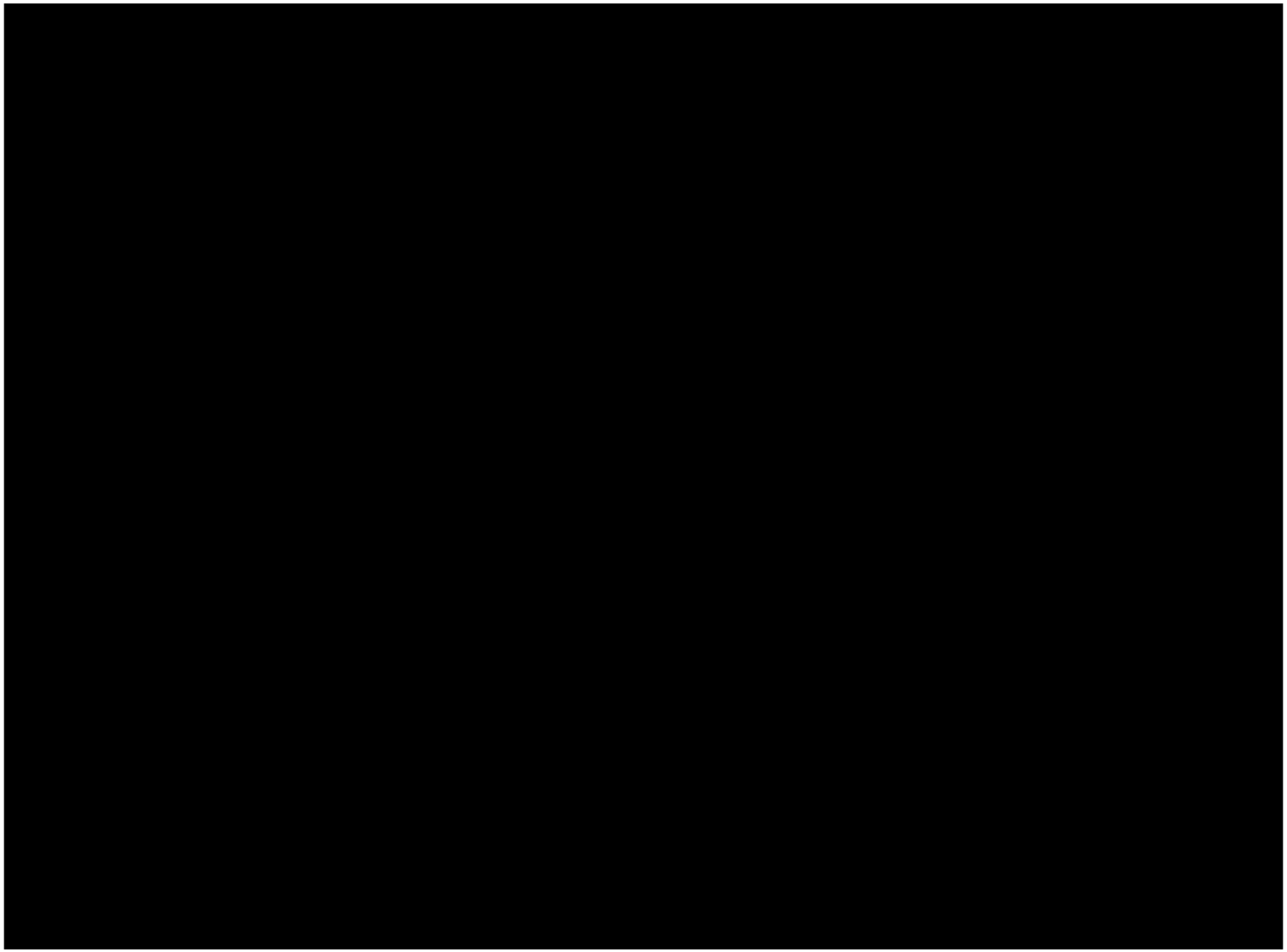

**Figure 10-1. Map of the site resources, land parcels, and infrastructure with oil and gas wells. The AoR (pressure plume) is the blue line.**

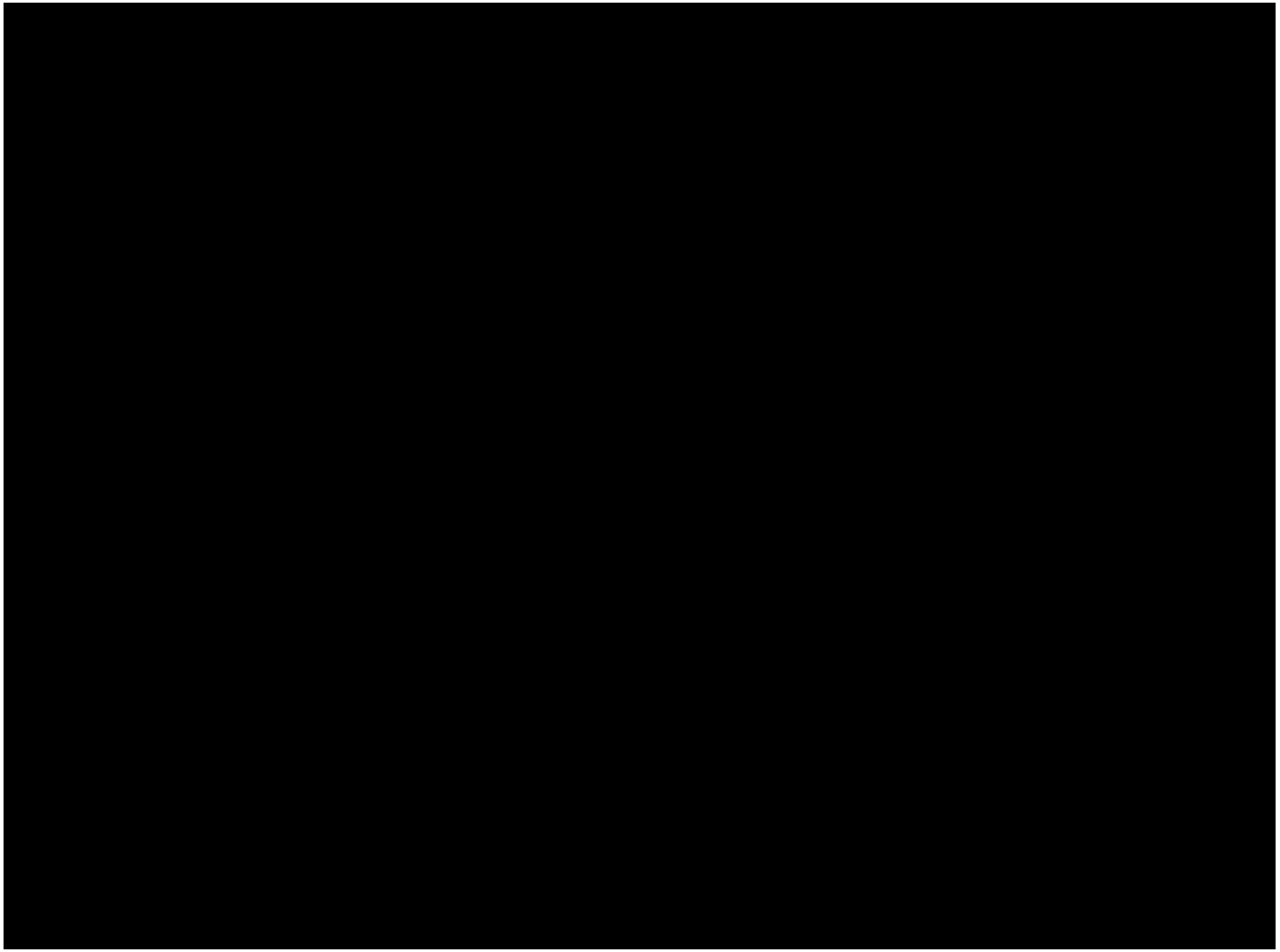

**Figure 10-2. Map of the site resources, land parcels, and infrastructure with water wells. The AoR (pressure plume) is the blue line.**

## 10.3 Potential Risk Scenarios

The following risk scenarios for TCCSP were assessed in **Appendix A (Table 10-4)** and represent those that could potentially result in an emergency response:

- Fluid (e.g. brine) communication between formations while drilling
- Subsidence affecting surface infrastructure
- Fluid (e.g. brine) or $CO_2$ leakage into or near USDW or ground surface through wellbore (injection, monitoring, P&A, or other), surface equipment failure, or confining zone failure
- External impact to project wellhead, pipelines, or surface equipment
- Loss of mechanical integrity (injection or monitoring wells)
- Loss of containment (vertical migration) of $CO_2$ or brine via injection or monitoring wells, or pressure propagation
- Loss of containment (lateral migration) of $CO_2$ or brine outside of defined AoR
- Injection or monitoring equipment failure/malfunction
- Induced seismicity
- Natural disaster (hurricane, earthquake, tornado, lightning, flood, wildfire)
- Accident or unplanned event (e.g., electrical outage causing injection to stop, unauthorized activity)

These events may occur during the construction, injection, or PISC periods. **Table 10-1** outlines these potential events that may require an emergency response at each stage of TCCSP project development, along with their associated severity and corresponding detailed risk scenario in **Appendix A (Table 10-4).** The degrees of risk for emergency events are defined in **Table 10-2** and match U.S. EPA Region 09 guidance.

**Table 10-1. Risk scenario matrix for TCCSP.**

| Risk Scenario | Construction Period | Injection Period | PISC Period | Degree of Risk | Appendix A Item Number |
|---|---|---|---|---|---|
| Fluid communication between formations while drilling | | | | | |
| Subsidence affecting surface infrastructure | | | | | |
| Fluid (e.g. brine) or $CO_2$ leakage into or near USDW or ground surface through wellbore (injection, monitoring, P&A, or other), surface equipment failure, or confining zone failure | | | | | |
| External impact to project wellhead, pipelines, or surface equipment | | | | | |
| Loss of mechanical integrity (injection or monitoring wells) | | | | | |
| Loss of containment (vertical migration) of $CO_2$ or brine via injection or monitoring wells, or pressure propagation | | | | | |
| Loss of containment (lateral migration) of $CO_2$ or brine outside of defined AoR | | | | | |
| Injection or monitoring equipment failure/malfunction | | | | | |
| Induced seismicity | | | | | |
| Natural disaster (hurricane, earthquake, tornado, lightning, flood, wildfire) | | | | | |
| Accident or unplanned event (e.g., electrical outage causing injection to stop, unauthorized activity) | | | | | |

**Table 10-2. Degrees of risk for emergency events.**

| Degree of Risk | Definition |
|---|---|
| Major Emergency | The 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 | The 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 | The event poses no immediate risk to human health, resources, or infrastructure. |

## 10.4 Emergency Identification and Response Actions

Steps to identify and characterize the event will be dependent upon the specific issue identified and the severity of the event. The following actions will be taken by TCCSP, LLC. if, through monitoring activities, there is evidence that a major or serious 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 notifying the UIC Program Director.
4. 24-Hour Emergency Contact will contact the response personnel listed in the column headed "Response Personnel" in **Appendix A** (**Table 10-4**) as needed.
5. Implement of the approved and applicable response action per **Appendix A** (**Table 10-4).**

Where the phrase "initiate the emergency shutdown plan" is used, the following protocol will be employed: TCCSP, LLC. will endeavor to immediately cease injection; however, in some circumstances, TCCSP, LLC. will, in consultation with the UIC Program Director, determine whether gradual cessation of injection (using the parameters set forth in **Appendix A** (**Table 10-4**) of this plan) is appropriate. Additionally, if necessary, TCCSP, LLC. will pursue actions to address CO2 escape from the permitted injection interval that may cause endangerment to USDWs.

The risk scenarios outlined in  and response actions for these risk scenarios are summarized in **Appendix A** (**Table 10-4**). The appropriate response will depend on the nature of the emergency and the severity of the event.  A formal risk assessment will be conducted to determine risk severity prior to requesting permission to operate, with a formal risk assessment report provided to the UIC Program Director.

The potential risk scenarios identified in section **10.3** of this plan and detailed in **Appendix A** (**Table 10-4**) are based on TCCSP, LLC. and TCCSP, LLC.'s contractors' experience and understanding of local field operations. 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 (Table 10-5)** 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** (**Table 10-4**).

### *10.4.1 Induced Seismic Event*

Based on the project operating conditions, it is highly unlikely that injection operations would ever induce a seismic event outside the area of review. Therefore, this portion of the response plan is developed for any seismic event with an epicenter near the injection and monitoring wells. [redacted]. Additional details on the monitoring locations and measurement methods can be found in the **Testing and Monitoring Plan**.

Based on the periodic analysis of the monitoring data, observed level of seismic activity, and local reporting of felt events, the site will be assigned an operating state. The operating state is determined using threshold criteria which 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.

The seismic monitoring system structure is presented in **Table 10-3**. The table corresponds to each level of operating state with the threshold conditions and operational response actions.

**Table 10-3. Seismic monitoring system, for seismic events > M1.0 with an epicenter within the project AoR.**

| Operating State | Threshold Condition[1,2] | Response Action[3] |
|---|---|---|
| Green | Seismic events less than or equal to M1.5 | 1. Continue normal operation within permitted levels. |
| Yellow | Five (5) or more seismic events within a 30-day period having a magnitude greater than M1.5 but less than or equal to M2.0 | 1. Continue normal operation within permitted levels.<br>2. Within 24 hours of the incident, notify the UIC Program Director of the operating status of the well. |
| Orange | Seismic event greater than M1.5 and local observation or felt report | 1. Continue normal operation within permitted levels.<br>2. Within 24 hours of the incident, notify the UIC Program Director of the operating status of the well.<br>3. Review seismic and operational data.<br>4. Report findings to the UIC Program Director and issue corrective actions. |
| | Seismic event greater than M2.0 and no felt report | |

[1] Specified magnitudes refer to magnitudes determined by local ISGS or USGS seismic monitoring stations or reported by the USGS National Earthquake Information Center using the national seismic network.
[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 UIC Program Director 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 M2.7 and local observation or report | 1. Initiate rate reduction plan.<br>2. Within 24 hours of the incident, notify the UIC Program Director of the operating status of the well.<br>3. Communicate with facility personnel and local authorities to initiate evacuation plans, as necessary.<br>4. 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 UIC Program Director).<br>5. Determine if leaks to ground water or surface water occurred.<br>6. If USDW contamination is detected:<br>a. Notify the UIC Program Director within 24 hours of the determination.<br>b. Initiate shutdown plan.<br>c. Shut in well (close flow valve).<br>d. Vent $CO_2$ from surface facilities.<br>e. Collect a confirmation sample(s) of groundwater and analyze for indicator parameters. (Potential indictors are listed in the *Testing and Monitoring Plan*.)<br>f. If the presence of indicator parameters is confirmed, develop (in consultation with the UIC Program Director) a case-specific work plan to:<br>i. Install additional groundwater monitoring points near the affected groundwater well(s) to delineate the extent of impact; and<br>ii. Remediate unacceptable impacts to the affected USDW.<br>g. Arrange for an alternate potable water supply, if the USDW was being utilized and has been caused to exceed drinking water standards.<br>h. Proceed with efforts to remediate USDW to mitigate any unsafe conditions (e.g., install system to intercept/extract brine or $CO_2$ or "pump and treat" to aerate $CO_2$-laden water).<br>7. Review seismic and operational data.<br>8. Report findings to the UIC Program Director and issue corrective actions. |

| Operating State | Threshold Condition[1,2] | Response Action[3] |
|---|---|---|
| **Red** | Seismic event greater than M2.7, and local observation or report, and local report and confirmation of damage[4] | 1. Initiate shutdown plan.<br>2. Within 24 hours of the incident, notify the UIC Program Director of the operating status of the well. |

[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.

| Operating State | Threshold Condition[1,2] | Response Action[3] |
|---|---|---|
| | Seismic event >M3.5 | 3. Communicate with facility personnel and local authorities to initiate evacuation plans, as necessary.<br>4. 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 UIC Program Director).<br>5. Determine if leaks to ground water or surface water occurred.<br>6. If USDW contamination is detected:<br>a. Notify the UIC Program Director within 24 hours of the determination.<br>b. Initiate shutdown plan.<br>c. Shut in well (close flow valve).<br>d. Vent $CO_2$ from surface facilities.<br>e. Collect a confirmation sample(s) of groundwater and analyze for indicator parameters. (Potential indictors are listed in the *Testing and Monitoring Plan*.)<br>f. If the presence of indicator parameters is confirmed, develop (in consultation with the UIC Program Director) a case-specific work plan to:<br>i. Install additional groundwater monitoring points near the affected groundwater well(s) to delineate the extent of impact; and<br>ii. Remediate unacceptable impacts to the affected USDW.<br>g. Arrange for an alternate potable water supply, if the USDW was being utilized and has been caused to exceed drinking water standards.<br>h. Proceed with efforts to remediate USDW to mitigate any unsafe conditions (e.g., install system to intercept/extract brine or $CO_2$ or "pump and treat" to aerate $CO_2$-laden water).<br>7. Review seismic and operational data.<br>8. Report findings to the UIC Program Director and issue corrective actions. |

## 10.5 Response Personnel and Equipment

Site personnel, project personnel, and local authorities will be critical to successful implementation of this **ERRP**. Emergency responders (as well as state agencies) may need to be notified in the event of an emergency. Please refer to **Appendix B (Table 10-5)** for an emergency contact list, this list 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 as specified for each potential risk scenario in **Appendix A** (**Table 10-4**). Response actions (cessation of injection, well shut-in, and evacuation) will generally not require specialized equipment to implement. TCCSP, LLC. will be responsible for procurement of any necessary additional specialized equipment (e.g., drilling rigs or logging equipment).

## 10.6 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 (Table 10-5)** of this **ERRP** as soon as possible after requesting outside assistance from local emergency responders.

TCCSP, LLC. will communicate to the public about any event that requires an emergency response to ensure the public understands the nature of the event and any environmental, health, or safety implications arising from it. The amount of information, timing, and communication method(s) will be tailored to the event; its severity; impacts on drinking water, other environmental resources, or the surrounding community; and the public's awareness of the event.

In the case of an emergency that requires an evacuation, TCCSP, LLC. will communicate and work with the Local Emergency Planning Committee (LEPC), coordinated by the California State Emergency Response Commission (SERC), Tulare County's Office of Emergency Services (OES) and Emergency Operations Center (EOC), and the fire department to evacuate the public from the affected areas. In addition, TCCSP, LLC. will work closely with the mayors and judges in the affected areas to issue a mandatory evacuation order for the public, if necessary.

TCCSP, LLC. will describe what happened, any actual or potential 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), TCCSP, LLC. will provide periodic updates on the progress of the response action(s).

TCCSP, LLC. will communicate with entities who may need to be informed about or act in response to the event, including local water system(s), management organization(s), $CO_2$ source(s), management organization(s), pipeline operator(s), landowners, Regional Response Teams (as part of the National Response Team), and local authorities.

## 10.7 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 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 (Table 10-5)** 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, TCCSP, LLC. will provide the UIC Program Director with the documentation supporting that no amendment is necessary. 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).

## 10.8 Staff Training and Exercise Procedures

TCCSP, LLC. will integrate this plan into its existing operating procedures and training protocols. TCCSP, LLC. will determine the required training programs for each employee commensurate with their job function, safety requirements, and regulatory requirements. All storage complex employees will be trained—this training will be documented prior to commencing injection. TCCSP, 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. TCCSP, LLC. will provide information about employee training status, schedules, and coursework to appropriate authorities upon request and prior to commencing injection.

All TCCSP, LLC. field personnel will be trained and equipped with the necessary skills to ensure a safe working environment and to respond correctly in case of an emergency. TCCSP, LLC. will reference the following standards established by the American Petroleum Institute (API) in their training program:

- API Recommended Practice 54 – Recommended Practice for Occupational Safety for Oil and Gas Well Drilling and Servicing Operations
- API Recommended Practice 74 – Recommended Practice for Occupational Safety for Onshore Oil and Gas Production Operations
- API Bulletin 75L – Guidance Document for the Development of a Safety and Environmental Management System for Onshore Oil and Natural Gas Production Operations and Associated Activities.
- API Recommended Practice 76 – Contractor Safety Management for Oil and Gas Drilling and Production Operations
- API Standard 2220 – Contractor Safety Performance Process

These recommended practices will be reviewed by TCCSP, LLC. to design and implement training programs that are adequate for the field personnel generally and specific for unique job functions. The field personnel will go through a field probation period of no less than a month and no more than a year. This probation period will ensure that personnel can respond adequately and quickly in case of an emergency.

TCCSP, 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
- Risk management for oil and gas field operations

Periodic training will be provided, not less than annually, to construction personnel, well operators, project safety personnel, environmental personnel, the operations manager, and corporate communications. 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 this **ERRP**.

## 10.9 Communications with Landowners and Response Personnel

Prior to the start of $CO_2$ injection operations, TCCSP, LLC. will attempt to promptly communicate with landowners living within the AoR as identified on **Figure 10-1** and **Figure 10-2** to provide information of the nature of the operations, potential risks, and appropriate response approaches under various emergency scenarios. This will include briefings on the potential hazards and characteristics of $CO_2$.

## 10.10 Appendix A: Emergency Remedial and Response Risk Scenarios

**Table 10-4. Risk assessment matrix (RAM).**

| | 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. | [redacted] | [redacted] | **Drilling:**<br>* Stop operation<br>* Close BOP<br>* Clear floor and secure area<br>* Execute well control procedure<br>* Evaluate drilling parameters to identify root cause<br>* Notify 24-Hour Emergency Contact and UIC Program Director and propose an action plan based on the finding<br>* Continue operations following UIC Program Director approval and the determination that operations will not endanger USDWs | * Project manager<br>* Rig crew<br>* Rig manager<br>* Field superintendent |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | **Completion:**<br>* Stop operations<br>* Close BOP<br>* Clear floor and secure area<br>* Execute well control procedure<br>* Notify 24-Hour Emergency Contact and UIC Program Director and propose remediation plans.<br>* Continue operations following UIC Program Director approval and the determination that operations will not endanger USDWs | |
| 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 | [redacted] | [redacted] | * In case of influx, control the well, without compromising the shoe integrity<br><br>* In the case of the shoe leaking, squeeze to regain integrity | * Project manager<br>* Rig crew<br>* Rig manager<br>* Field superintendent |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | source of drinking water (USDW). | | [redacted] | * In the case of the surface casing leaking, squeeze or install a casing patch.<br><br>* Notify 24-Hour Emergency Contact and UIC Program Director and propose remediation plans.<br><br>* Delineate and monitor the extent of the leak, and if necessary, enact remedial efforts to the affected USDW. | |
| 3 | Construction Period | ***Unauthorized access/activity:*** Unauthorized activity on field site | [redacted] | | * Report any incidents to local Sheriff's office | * Field superintendent<br><br>* Company man |
| 4 | Construction/Injection Period | ***Subsidence:*** Sinking of the land surface affecting structures and equipment on surface such as wellpads, pipe manifold, and | | | * Halt injection and inspect affected structures<br><br>* Conduct oil gas/air quality studies to ensure | * Construction crew<br><br>* Environmental manager |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | temporary living quarters. | [redacted] | [redacted] | no leakage or contamination of local resources | |
| 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, which 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. | | | * Trigger Emergency Shutdown system<br>* DCS alarms notification to operations staff<br>* Follow protocol to stop operation, vent, or deviate $CO_2$<br>* Notify 24-Hour Emergency Contact<br>* Troubleshoot the well<br>* If tubing leak is detected, notify UIC Program Director and propose an action plan | * Operations manager<br>* Field superintendent<br>* Project manager<br>* Environmental Manager |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | based on the finding<br><br>* Schedule well service to repair tubing | |
| 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. | [redacted] | | * Trigger Emergency Shutdown system<br><br>* DCS alarms notification to operations staff<br><br>* Notify 24-Hour Emergency Contact<br><br>* Troubleshoot the well<br><br>* Notify UIC Program Director and propose an action plan for well service<br><br>* Schedule well service to repair tubing, isolate $CO_2$ zone, or | * Operations manager<br><br>* Field superintendent<br><br>* Project manager<br><br>* Rig Crew and Down Hole contractors<br><br>* Environmental Manager |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | [redacted] | | abandon the well | |
| 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, and into different formations of the injection target or into USDW. | | | * Trigger Emergency Shutdown system<br>* DCS alarms notification to operations staff<br>* Follow protocol to stop operation, vent, or deviate $CO_2$<br>* Notify 24-Hour Emergency Contact<br>* Troubleshoot the well.<br>* 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 | * Operations manager<br>* Field superintendent<br>* Project manager<br>* Rig Crew and Down Hole contractors<br>* Remediation contractors<br>*Environmental Manager |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | UIC Program Director<br><br>* Notify UIC Program Director and propose an action plan based on the finding and location of the leak<br><br>* Schedule well service to repair the casing | |
| 8 | Injection period | ***Unauthorized access/activity:*** Unauthorized activity on filed site | [redacted] | [redacted] | * Report any incidents to local Sheriff's office | *Field superintendent<br><br>*Company man |
| 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. | | | * Trigger Emergency Shutdown system<br><br>* DCS alarms notification to operations staff | * Operations manager<br><br>* Field superintendent<br><br>* Project manager |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | This event could cause a migration of $CO_2$ and brines through the casing, the cement, and into different formations of the injection target or into USDW. | [redacted] | | * Notify 24-Hour Emergency Contact<br><br>* Troubleshoot the well<br><br>* 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<br><br>* Notify UIC Program Director and propose an action plan based on the findings and the location of the leak.<br><br>* Schedule well service to repair the casing | * Rig Crew and Down Hole contractors<br><br>* Remediation contractors<br><br>*Environmental Manager |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| 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. | [redacted] | [redacted] | * Notify 24-Hour Emergency Contact<br><br>* Evaluate if it's a positive $CO_2$ release because of a leak in the legacy/P&A well<br><br>* Notify regulator and propose plan to repair the well, delineate the area, and identify potential resources affected<br><br>* Discuss specific remediation actions and monitoring plans<br><br>* Execute program, monitor, and evaluate efficacy | * Operations manager<br><br>* Field superintendent<br><br>* Project manager<br><br>* Rig Crew and Down Hole contractors<br><br>* Remediation contractors<br><br>*Environmental Manager |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| 11 | Injection Period/ Post-Injection Site Care Period | ***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. | [redacted] | | * Notify 24-Hour Emergency Contact<br>* Assess root cause by reviewing monitoring data<br>* Notify UIC Program Director<br>* If necessary, follow protocol to stop injection.<br>* If necessary, conduct [redacted] to delineate potential leak path<br>* Evaluate if there is a movement of $CO_2$ or brines to USDW. If USDW gets affected, discuss with | * Operations manager<br>* Field superintendent<br>* Geologist<br>* Reservoir engineer<br>* Project manager<br>* Remediation contractors<br>*Environmental Manager |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | UIC Program Director remediation options, action plan, and monitoring program.<br><br>* Actions to restore injection will depend on the nature of the leak path and the extent. Operator will reevaluate model and discuss action plan with UIC Program Director | |
| 12 | Injection Period | ***Fluid Leakage - Geomechanical Seal Failure***<br>Elevated well bottomhole pressure (BHP) either exceeds the permitted maximum injection pressure or the estimated maximum injection pressure is inaccurate (i.e., the true | [redacted] | | * Trigger Emergency Shutdown system<br><br>* DCS alarms notification to operations staff<br><br>* Follow protocol to stop injection | * Operations manager<br><br>* Field superintendent<br><br>* Monitoring staff<br><br>* Geologist<br><br>* Reservoir engineer |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | 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). | [redacted] | [redacted] | * Designate an exclusion zone, and provide appropriate PPE for protection of onsite personnel<br><br>* Notify 24-Hour Emergency Contact<br><br>* Assess root cause by reviewing monitoring data<br><br>* If required, conduct [redacted] to delineate potential leakage pathway<br><br>* Evaluate if there is a movement of $CO_2$ or brines to USDW.<br><br>* Notify UIC Program Director and propose | * Project manager<br><br>* Remediation contractors<br><br>*Environmental Manager |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | remediation options, action plan, and monitoring program<br><br>* Actions to restore injection will depend on the nature of the leak path and the extent. Operator will reevaluate model and discuss action plan with UIC Program Director | |
| 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. | [redacted] | | * Trigger Emergency Shutdown system<br><br>* DCS alarms notification to operations staff<br><br>* Designate an exclusion zone, and provide appropriate PPE for protection | * Operations manager<br><br>*Field superintendent<br><br>*Project manager<br><br>*Plant manager<br><br>*Remediation contractors |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | [redacted] | of onsite personnel<br><br>* Follow protocol to shut down $CO_2$ delivery<br><br>* If there are injured personnel, call emergency team, and execute evacuation protocol<br><br>* Notify 24-Hour Emergency Contact<br><br>* Clear location and secure the perimeter. If possible, install containment devices around the location.<br><br>* Evaluate environmental impact (soil, water, fauna, vegetation), | * Environmental Manager |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | * Assess mechanical integrity of the system<br><br>* Notify UIC Program Director and propose repair actions<br><br>* Repair or replace equipment | |
| 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. | [redacted] | [redacted] | * DCS alarms notification to operations staff<br><br>* If there are injured personnel, call emergency team, and execute evacuation protocol<br><br>* Notify 24-Hour Emergency Contact | * Operations manager<br><br>*Field superintendent<br><br>*Plant manager<br><br>*Remediation contractors<br><br>*Emergency teams<br><br>*Environmental Manager |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | * Clear location and secure the perimeter.<br><br>* Evaluate environmental impact<br><br>* Assess mechanical integrity of the system<br><br>* Notify UIC Program Director and propose repair actions<br><br>* Repair or replace equipment | |
| 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 | [redacted] | | * DCS alarms notification to operations staff<br><br>* Follow protocol to shut down $CO_2$ delivery<br><br>* If there are injured personnel, call emergency | * Operations manager<br><br>*Field superintendent<br><br>*Plant manager<br><br>*Remediation contractors |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | detect the change, resulting in a $CO_2$ leak. | | [redacted] | team, and execute evacuation protocol<br><br>* Notify 24-Hour Emergency Contact to activate emergency plan, reverse 9-1-1 protocol for residents or occupants in proximity to occurrence.<br><br>* Clear location and secure the perimeter. If possible, install containment devices around the location.<br><br>* Evaluate environmental impact (soil, water, fauna, vegetation),<br><br>* Assess mechanical | *Environmental Manager |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | integrity of the system<br><br>* Notify UIC Program Director and propose repair actions<br><br>* Repair or replace equipment | |
| 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. | [redacted] | [redacted] | * Trigger Emergency isolation valves<br><br>* DCS alarms notification to operations staff<br><br>* Follow protocol to shut down $CO_2$ delivery if the automatic shutoff device is not functional<br><br>* If there are injured personnel, call emergency team, and execute | * Operations manager<br><br>* Field superintendent<br><br>* Project manager<br><br>*Remediation contractors<br><br>*Emergency teams<br><br>*Environmental Manager |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | evacuation protocol<br><br>* Notify 24-Hour Emergency Contact<br><br>* Clear the location and secure the perimeter. If possible, install containment devices around the location.<br><br>*Assess mechanical integrity of the [redacted]<br><br>* Notify UIC Program Director and propose action plan<br><br>* Evaluate environmental impact (soil, water, fauna, vegetation), and present remediation | |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | plan to the UIC Program Director for approval<br><br>* Execute remediation, and install additional monitoring system as needed | |
| 17 | Injection Period | ***Fluid Leakage – Surface Infrastructure:*** Failure of $CO_2$ transport flowlines from the $CO_2$ capture system to TCCSP $CO_2$ injection wellhead. | [redacted] | [redacted] | * DCS alarms notification to operations staff<br><br>* Follow protocol to shut down $CO_2$ delivery<br><br>* Detect $CO_2$ stream release and its location<br><br>* Initiate evacuation plan<br><br>* Notify 24-Hour Emergency Contact<br><br>* Transmission line and/or flowline failure | * Operations manager<br><br>* Field superintendent<br><br>* Remediation contractors<br><br>* Emergency teams<br><br>* Plant manager/contact<br><br>*Environmental Manager |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | will be inspected to determine the root cause of the failure<br><br>* Notify UIC Program Director and propose action plan<br><br>* Repair/replace the damaged transmission line or flowline, and if warranted, put in place the measures necessary to eliminate such events in the future | |
| 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 | [redacted] | | * Trigger Emergency Shutdown system<br><br>* DCS alarms notification to operations staff | * Operations manager<br><br>* Field superintendent<br><br>* Project manager |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | $CO_2$ pressure and plume.<br><br>Changes in temperature and injection pressure create stresses in the tubulars trying to expand or contract, and lead to microannulus effects, resulting in fugitive movement of brines/$CO_2$. | [redacted] | [redacted] | * Follow protocol to stop operation, vent, or deviate $CO_2$<br><br>* Notify 24-Hour Emergency Contact<br><br>* Troubleshoot the well<br><br>* Evaluate if there is a movement of $CO_2$ or brines to USDW.<br><br>* Notify UIC Program Director and discuss action plan to repair the well or P&A based on the findings of the assessment | * Rig Crew and Down Hole contractors<br><br>* Remediation contractors<br><br>* Environmental Manager |
| 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 | | | * Trigger Emergency Shutdown system | * Operations manager<br><br>* Field superintendent |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | chemical reactions on the tubulars and cement exposed to the $CO_2$ pressure and plume.<br><br>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/$CO_2$. | [redacted] | [redacted] | * DCS alarms notification to operations staff<br><br>* Notify 24-Hour Emergency Contact<br><br>* Troubleshoot the well.<br><br>* Evaluate if there is a movement of $CO_2$ or brines to USDW.<br><br>* Notify UIC Program Director and discuss action plan to repair the well or P&A based on the findings of the assessment | * Project manager<br><br>* Rig Crew and Down Hole contractors<br><br>* Remediation contractors<br><br>* Environmental Manager |
| 20 | Injection Period/ Post-Injection Site Care Period | ***Loss of Containment-Lateral Migration of $CO_2$ Outside Modeled $CO_2$ Plumes:***<br>The $CO_2$ plume moves faster or in an unexpected pattern and expands beyond the | | | <u>Injection period:</u><br><br>* Trigger Emergency Shutdown system | * Operations manager<br><br>* Field superintendent<br><br>* Geologist |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | secured pore space for the project and the AoR. | [redacted] | [redacted] | * DCS alarms notification to operations staff<br><br>* Notify 24-Hour Emergency Contact<br><br>* Review monitoring data and trends and compare with the simulation.<br><br>* Notify UIC Program Director, 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.<br><br>* [redacted] | * Reservoir engineers<br><br>* Project manager<br><br>* Environmental Manager |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | * Conduct [redacted] as required to evaluate AoR.<br><br>* Recalibrate model and simulate new AoR<br><br>* Assess if additional corrective actions are needed and if it's required to secure additional pore space<br><br>* Assess if any remediation is needed, and discuss action plan with UIC Program Director<br><br>* Present AoR review to UIC Program Director for approval and | |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | adjust monitoring plan<br><br><u>Post-Injection Site Care Period:</u><br><br>* DCS alarms notification to monitoring personnel<br><br>* Notify 24-Hour Emergency Contact<br><br>* Review monitoring data and trends, compare with the simulation<br><br>* Notify UIC Program Director and propose action plan<br><br>* Conduct [redacted] as | |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | required to evaluate AoR<br><br>* Recalibrate model, and simulate new AoR<br><br>* Assess if additional corrective actions are needed and if it's required to secure additional pore space<br><br>* Assess if any remediation is needed, and discuss action plan with UIC Program Director | |
| 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 | [redacted] | [redacted] | <u>Injection period:</u><br><br>* Identification by monitoring staff | * Operations manager<br><br>* Field superintendent<br><br>* Monitoring staff |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | (i.e., an artificial penetration that is perforated in both intervals). | [redacted] | | * Notify 24-Hour Emergency Contact<br><br>* Review monitoring data and trends and compare with the simulation<br><br>* If endangerment to USDW is suspected follow shut down procedure.<br><br>* 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 | * Geologist<br><br>* Reservoir engineers<br><br>* Project manager<br><br>* Remediation contractors<br><br>* Environmental Manager |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | * [redacted] used to verify detected containment loss.<br><br>* Conduct [redacted] as required to evaluate AoR<br><br>* Recalibrate model and simulate new AoR<br><br>* Assess if additional corrective actions are needed and if it's required to secure additional pore space<br><br>* Assess if any remediation is needed, and discuss action plan with UIC | |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | Program Director<br><br>* Present AoR review to UIC Program Director for approval and adjust monitoring plan<br><br><u>Post-Injection Site Care Period:</u><br><br>* Identification by monitoring staff<br><br>* Notify 24-Hour Emergency Contact<br><br>* Review monitoring data and trends and compare with simulations<br><br>* Notify UIC Program Director and | |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | propose action plan<br><br>* Conduct [redacted] as required to evaluate AoR<br><br>* Recalibrate model, and simulate new AoR<br><br>* Assess if additional corrective actions are needed and if it's required to secure additional pore space<br><br>* 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 | |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | UIC Program Director | |
| 22 | Injection Period | ***External impact – UIC Well:*** During injection the well gets disconnected from the pipeline and from the shutoff system and leads to a loss of containment of $CO_2$. | [redacted] | [redacted] | * Trigger emergency isolation valves<br>* DCS notification to monitoring or operations staff<br>* Follow protocol to shut down $CO_2$ delivery if the automatic shutoff device is not functional<br>* Designate an exclusion zone, and provide appropriate PPE for protection of onsite personnel<br>* If there are injured personnel, call emergency team, and execute | * Operations manager<br>* Field superintendent<br>* Project manager<br>* Rig Crew and Down Hole contractors<br>* Remediation contractors<br>* Well control specialist<br>* Environmental Manager |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | evacuation protocol<br><br>* Notify 24-Hour Emergency Contact<br><br>* Clear the location and secure the perimeter.<br><br>* 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.<br><br>* Evaluate environmental impact (soil, water, fauna, vegetation) | |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | * Notify UIC Program Director<br><br>* Execute remediation, and install monitoring system as needed | |
| 23 | Injection Period/ Post-Injection Site Care Period | ***External impact – MW:*** The wellhead of the in-zone monitoring well is damaged leading to a loss of containment. 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. | [redacted] | [redacted] | * DCS alarms notification to operations staff<br><br>* Designate an exclusion zone, and provide appropriate PPE for protection of onsite personnel<br><br>* If there are injured personnel, call emergency team, and execute evacuation protocol | * Operations manager<br><br>* Field superintendent<br><br>* Project manager<br><br>* Rig Crew and Down Hole contractors<br><br>* Remediation contractors<br><br>* Well control specialist<br><br>*Environmental Manager |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | * Notify 24-Hour Emergency Contact<br><br>* Clear the location and secure the perimeter. If possible, install containment devices around the location.<br><br>* Contact well control special team to execute 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 observation well.<br><br>* Evaluate environmental impact (soil, | |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | water, fauna, vegetation)<br><br>* Notify UIC Program Director and propose action plan<br><br>* Execute remediation, and install monitoring system as needed | |
| 24 | 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. | [redacted] | | * DCS alarms notification to operations staff<br><br>* If there are injured personnel, call emergency team, and execute evacuation protocol<br><br>* Designate an exclusion zone, and provide appropriate PPE | * Operations manager<br><br>* Field superintendent<br><br>* Remediation contractors<br><br>* Emergency teams<br><br>* Plant manager/<br><br>* Environmental Manager |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | [redacted] | for protection of onsite personnel<br><br>* Notify 24-Hour Emergency Contact<br><br>* Assess mechanical integrity of the system, and propose repair actions if needed<br><br>* Assess any potential environmental impact<br><br>* Notify UIC Program Director and propose action plan<br><br>* Repair or replace instrumentation. Calibrate equipment.<br><br>* Review monitoring records, and if | |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | needed, perform an injectivity test or falloff test to evaluate reservoir | |
| 25 | Injection Period/ Post-Injection Site Care Period | ***Injection or Monitoring Equipment Failure:*** Failure of surface injection or monitoring equipment including valves, gauges, meters, sensors, electrical, or other equipment results in potentially unsafe operating conditions and requires an emergency response at the site. | [redacted] | [redacted] | * DCS alarms notification to operations staff<br>* If there are injured personnel, call emergency team, and execute evacuation protocol<br>* Designate an exclusion zone, and provide appropriate PPE for protection of onsite personnel<br>* Notify 24-Hour Emergency Contact<br>* Assess mechanical integrity of the | * Operations manager<br>* Field superintendent<br>* Project manager<br>* Remediation contractors<br>* Emergency teams<br>* Geologist<br>* Reservoir engineers<br>* Monitoring staff<br>*Environmental Manager |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | system, and propose repair actions if needed<br><br>* Assess any potential environmental impact<br><br>* Notify UIC Program Director and propose action plan<br><br>* Perform Lockout/Tagout (LOTO) for defective equipment until it is properly replaced<br><br>* Repair or replace instrumentation. Calibrate equipment.<br><br>* If the assessment allows resuming injection safely, | |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | discuss plan with the UIC Program Director and get approval | |
| 26 | 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. | [redacted] | | * DCS alarms notification to operations staff<br>* If there are injured personnel, call emergency team, and execute evacuation protocol<br>* Notify 24-Hour Emergency Contact<br>* Assess mechanical integrity of the system, and propose repair actions if needed<br>* Assess any potential | * Operations manager<br>* Field superintendent<br>* Project manager<br>* Remediation contractors<br>* Emergency teams<br>* Geologist<br>* Reservoir engineers<br>* Monitoring staff<br>*Environmental Manager |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | environmental impact<br><br>* Notify UIC Program Director and propose action plan<br><br>* If the assessment allows resuming injection safely, discuss plan with the UIC Program Director and get approval<br><br>* Repair or replace instrumentation. Calibrate equipment.<br><br>* Review monitoring records, and if needed, perform an injectivity test or falloff test to | |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | evaluate reservoir | |
| 27 | 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). | [redacted] | [redacted] | * DCS alarms notification to operations staff<br>* If there are injured personnel, call emergency team, and execute evacuation protocol<br>* Designate an exclusion zone, and provide appropriate PPE for protection of onsite personnel<br>* Notify 24-Hour Emergency Contact<br>* Assess mechanical integrity of the system, and propose repair actions if needed | * Operations manager<br>* Field superintendent<br>* Project manager<br>* Remediation contractors<br>* Emergency teams<br>* Geologist<br>* Reservoir engineers<br>* Monitoring staff<br>* Environmental Manager |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | * Assess any potential environmental impact, and propose remedial action with the UIC Program Director, if needed<br><br>* If the assessment allows resuming injection safely, discuss plan with the UIC Program Director and obtain approval<br><br>* Repair or replace any damaged equipment and recalibrate<br><br>* Review monitoring records and, if needed, adjust $CO_2$ accordingly | |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| 28 | 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. | | [redacted] | * DCS alarms notification to operations staff<br><br>* If there are injured personnel or property damages, call emergency team, and execute evacuation protocol and secure location<br><br>* Notify 24-Hour Emergency Contact<br><br>* Assess any potential environmental impact<br><br>* Notify UIC Program Director and propose action plan, if needed<br><br>* Define new injection parameters and get approval | * Operations manager<br><br>*Field superintendent<br><br>*Plant manager<br><br>*Emergency teams<br><br>*Environmental Manager |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | from the UIC Program Director<br><br>* If the assessment allows resuming injection safely, increase surveillance to validate effectiveness of the actions | |
| 29 | 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. | | [redacted] | * DCS alarms notification to operations staff<br><br>* If there is injured personnel or property damage, call emergency team, and execute evacuation protocol and secure location<br><br>* Follow protocol to stop injection | * Operations manager<br><br>* Field superintendent<br><br>* Project manager<br><br>* Remediation contractors<br><br>* Emergency teams<br><br>* Geologist<br><br>* Reservoir engineers<br><br>* Monitoring staff |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | (injection period)<br><br>* Notify 24-Hour Emergency Contact<br><br>* Assess any potential environmental impact<br><br>* Notify UIC Program Director and propose action plan, if needed<br><br>* Review regional information as well as monitoring records to determine the origin of the event (natural or induced)<br><br>* If the assessment allows resuming injection safely, increase | *Environmental Manager |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | surveillance to validate effectiveness of the actions (injection period) | |
| 30 | Injection Period/ Post-Injection Site Care Period | ***Major seismic event***<br><br>Natural seismicity causes LOC by opening transmissive features in the confining zone, resulting in release of $CO_2$ to a USDW, surface, or atmosphere. | [redacted] | [redacted] | * DCS alarms notification to operations staff<br><br>* If there are injured personnel or property damage, call emergency team, and execute evacuation protocol and secure location<br><br>* Designate an exclusion zone, and provide appropriate PPE for protection of onsite personnel | * Operations manager<br><br>* Field superintendent<br><br>* Project manager<br><br>* Geologist<br><br>* Monitoring staff<br><br>* Remediation contractors<br><br>*Environmental Manager |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | * Notify 24-Hour Emergency Contact<br><br>* Assess any potential environmental impact<br><br>* Notify UIC Program Director and propose action plan, if needed<br><br>* If the assessment allows resuming injection safely, increase surveillance to validate effectiveness of the actions (injection period) | |
| 31 | Injection Period/ Post-Injection Site Care Period | ***Other Major Natural Disaster***<br>Natural disaster that limits or endangers the normal operation of the Project Site. | [redacted] | | * DCS alarms notification to operations staff<br><br>* If there is injured personnel or | * Operations manager<br><br>* Field superintendent |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | [redacted] | property damage, call emergency team, and execute evacuation protocol and secure location<br><br>* Follow protocol to stop injection<br><br>* Notify 24-Hour Emergency Contact<br><br>* Assess mechanical integrity of the system<br><br>* Assess any potential environmental impact<br><br>* Notify UIC Program Director and propose repair actions based on findings<br><br>* If the assessment | * Project manager<br><br>* Remediation contractors<br><br>* Emergency teams<br><br>* Geologist<br><br>* Reservoir engineers<br><br>* Monitoring staff<br><br>*Environmental Manager |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | allows resuming injection safely, increase surveillance to validate effectiveness of the actions | |
| 32 | Injection Period | ***Accidents or Unplanned Event:*** Loss of electricity causing injection to cease. | [redacted] | | * DCS alarms notification to operations staff<br>* DCS controller/UPS programmed to initiate a closure of shutdown valves in fail safe position (Fail-Closed)<br>* DCS controller/UPS will continue to monitor the shutdown and report back to the DCS system for personnel<br>* Designate an exclusion zone, and provide | * Operations manager<br>* Field superintendent<br>* Project manager<br>* Remediation contractors<br>* Emergency teams<br>* Geologist<br>* Reservoir engineers<br>* Monitoring staff<br>*Environmental Manager |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| | | | | | appropriate PPE for protection of onsite personnel<br><br>* Verify $CO_2$ flow was shut off by the system or start manual protocol to stop flow, visual inspection, and manually close valves.<br><br>* Notify 24-Hour Emergency Contact<br><br>* Notify UIC Program Director within 24-hours of shut-in<br><br>* Notify UIC Program Director of start-up procedure. | |

| | Project Phase | Risk Scenario | Monitoring Equipment | Control In Place | Response Action | Response Personnel |
|---|---|---|---|---|---|---|
| 33 | Post-injection period | ***Unauthorized access/activity:*** Unauthorized activity on field site | [redacted] | | * Report any incidents to local Sheriff's office | * Operations manager<br><br>* Field superintendent<br><br>* Project manager |

## 10.11 Appendix B: Emergency Contact List

**Table 10-5. Emergency contact phone numbers.**

| Facility Contacts | Phone Number |
|---|---|
| 24-Hour Emergency Contact During Construction:<br>Construction Manager – [redacted] | [redacted] |
| 24-Hour Emergency Contact During Operation and Post-Injection:<br>On-Duty Superintendent of Plant Operations - [redacted] | |
| **Local Agencies** | |
| Tulare County Sheriff's Emergency Services Unit | |
| Tulare County Sheriff's Office | |
| Tulare County Fire Department | |
| Region V Local Emergency Planning Committee | |
| **State Agencies** | |
| California Governor's Office of Emergency Services Warning Center | |
| State Emergency Response Commission | |
| State Warning Point (24-Hour) | |
| **Federal Agencies** | |
| U.S. EPA Region 09 UIC Class VI Program Director – [redacted] | |
| National Response Center (NRC) (24-Hour) | |

## 10.12 References

[1] Dewitz, J. "National Land Cover Database (NLCD) 2021 Products: U.S. Geological Survey Data Release," 2023. https://doi.org/10.5066/P9JZ7AO3.