ATTACHMENT I

EMERGENCY AND REMEDIAL RESPONSE PLAN (40 CFR 146.94(a))

1. FACILITY INFORMATION

Facility Name: CarbonFrontier

Facility Contact: Faisal Latif, Storage Development Manager
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Injection Well Information:

Well Number	County, State	Latitude	Longitude
CI1-64Z-27N	Kern County, CA	35°33'9.4877"N	119°48'26.3702"W
CI2-64Z-35N	Kern County, CA	35°32'32.6713"N	119°47'37.0682"W
CI3-64Z-35N	Kern County, CA	35°32'11.6457"N	119°47'7.5912"W
CI4-64Z-35N	Kern County, CA	35°31'55.4154"N	119°46'51.7864"W
27R-27N	Kern County, CA	35°33'2.4280"N	119°48'28.6103"W
55-26N	Kern County, CA	35°32'43.2520"N	119°47'32.7755"W
64-35N	Kern County, CA	35°31'44.3600"N	119°46'44.9788"W
9-1N	Kern County, CA	35°31'31.6480"N	119°46'37.0154"W
64-27N	Kern County, CA	35°32'38.0979"N	119°47'54.6576"W

Version History

File Name	Version	Date	Description of Change
Attachment I – Aera CCS E and R Response Plan.pdf	1	January 19, 2023	Original document
Attachment I – CarbonFrontier E and R Response Plan V2 04182024.pdf	2	April 18, 2024	Revisions made to reorganize and clarify event response actions
Attachment I – CarbonFrontier E and R Response Plan V3 10152024.pdf	3	October 10, 2024	Revisions made based on EPA Technical Review comments from September 12, 2024

This Emergency and Remedial Response Plan (ERRP) describes actions that Aera Energy LLC (Aera) shall take to address movement of the injection fluid or formation fluid in a manner that may endanger an underground source of drinking water (USDW) during the construction, operation, or post-injection site care periods for the proposed CarbonFrontier Carbon Capture and Sequestration (CCS) Project (Project). The Plan is provided to meet the requirements of Title 40 of the Code of Federal Regulation (40 CFR) 146.94, Emergency and Remedial Response.

If Aera obtains evidence that the injected CO_2 stream and/or associated pressure front may cause an endangerment to a USDW, human health and safety, or the environment, Aera will perform the following actions:

1. Cease injection.
2. Take the steps reasonably necessary to identify and characterize a release.
3. Notify the permitting agency [Underground Injection Control (UIC) Program Director and California Air Resources Board (CARB) Executive Officer] of the emergency event within 24 hours (hrs).
4. Implement applicable portions of the approved ERRP.

Where the phrase "initiate shutdown plan" is used, the following protocol will be employed: Aera will immediately cease injection in the affected well(s) and other wells that may exacerbate risk of leakage to affected well(s). However, in some circumstances, Aera will, in consultation with the UIC Program Director and CARB Executive Officer, determine whether gradual cessation of injection (using the parameters set forth in Class VI Permit, **Attachment A –** Summary of Operating and Reporting Requirements) is appropriate. Aera will follow all requests and directives from the UIC Program Director during an emergency event.

2. LOCAL RESOURCES AND INFRASTRUCTURE

The area surrounding the CarbonFrontier CCS project is primarily oil and gas production and undeveloped acreage on the southwest side of West Side Highway. East of the West Side Highway are agricultural fields and a materials/soil stockpile industrial facility. Resources in the vicinity of the CarbonFrontier CCS Project that may be affected as a result of an emergency event at the project site include the following:

- Oil and gas production infrastructure within the North and South Belridge oilfields, not directly associated with the project;
- Potential USDWs within area of review (AoR); however, there is no utilization of any potential USDWs within the AoR;
- A small housing tract on Lost Hills Road, north of Lerdo Hwy and roughly 5 miles southeast of the nearest injection well;
- State highways 33 and 46 and Interstate 5;
- The community of Lost Hills located more than 7 miles northeast of the nearest injection well;
- Public amenities at Blackwells Corner, approximately five miles northwest and Spicer City, approximately 9.5 miles southeast of the nearest injection well.

Resources and infrastructure addressed in this plan are shown in **Figure 1**, attached.

3. POTENTIAL RISK SCENARIOS

The following are events related to the CarbonFrontier CCS Project that could result in a need for an emergency response action:

- Injection well or monitoring well integrity failure: Loss of well integrity due to a leak in the casing, tubing, or packer which leads to a subsurface release or a migration of fluid through vertical channels adjacent to a well;
- Well injection or monitoring equipment failure: A failure of operating equipment such as sensors, gauges, wellheads, CO_2 pipelines, etc., which leads to the loss of monitoring data or a release of CO_2 at the surface;
- Fluid (e.g., formation water) or CO_2 leakage to a potential USDW or land surface;
- Natural disaster with effects that could impact site operations (e.g., earthquake, lightning strike, or grass fire); and,
- Induced seismic event.

Response actions will depend on the severity of the event(s) triggering an emergency response. Emergency conditions were ranked by comparing the risk categories of people, assets, environment, and governance with severity of event and likelihood of occurrence. "Emergency events" are categorized as shown in **Table 1**.

Table 1: Degrees of Risk for Emergency Events

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

4. EMERGENCY IDENTIFICATION AND RESPONSE ACTIONS

Steps to identify and characterize the event will be dependent on the specific issue identified, and the severity of the event. Actionable limits located in the Quality Assurance and Surveillance Plan (QASP) will be used to assist in ranking the severity of an event. The potential risk scenarios are detailed below.

4.1 Well Integrity Failure

A well integrity failure occurs when a leak exists in the well's casing, tubing, packer, or a channel adjacent to the wellbore. These failures may pose a risk of subsurface leakage of CO_2 or formation fluid out of the sequestration zone.

4.1.1 Potential Impacts

The potential consequences of an injection well or monitoring well integrity failure are the release of CO_2 or formation fluids outside of the sequestration zone and into a potential USDW in the AoR. If a release were to reach the surface, it may pose risk to on-site personnel in the vicinity.

4.1.2 Event Identification and Characterization

Events will be identified or detected by continuous pressure and flow rate monitoring, mechanical integrity tests, or groundwater analyses as described in **Attachment E – Testing and Monitoring Plan**.

A loss of well integrity may have occurred if the following events happen:

- Automatic shutdown devices are activated due to:
    - Wellhead pressure that exceeds the shutdown pressure specified in the permit.
    - Annulus pressure indicates a loss of external or internal well containment.
- Mechanical integrity test results identify a loss of mechanical integrity.
- CO_2 or fluids from the sequestration zone are detected above the primary confining layer.

Aera will notify the UIC Program Director and CARB Executive Officer within 24 hours of any triggering of a shut-off system per 40 CFR 146.91(c)(3) and CCS Protocol C.3.3(f), respectively

Within 24 hours of event detection, steps will be taken to classify the severity of a well integrity failure by the following criteria:

- **Minor Emergency:** A loss of mechanical integrity is identified but no release of CO_2 or formation fluids has occurred.
- **Serious Emergency:** A loss of mechanical integrity is identified, and a release of CO_2 or formation fluids has occurred above the primary confining layer, but below any potential USDWs.
- **Major Emergency:** A loss of mechanical integrity has occurred, and a release of CO_2 or formation fluids has occurred to USDWs.

4.1.3 Timing of Event

Injection phase.

4.1.4 Avoidance Measures

Avoidance measures are discussed below:

- Well Construction: Aera's well design and construction will consist of several barriers to protect groundwater from injected CO_2 in the injection well and from brine water from saline formation(s) in the monitoring well(s). The barriers include blowout preventors; compatible steel conductor pipe, surface casing, intermediate casing, outer long-string casing, tubing, and packers between tubing and casing strings; and cement between casing strings and between outermost casing and borehole.
- Operations: Aera will operate within the permit limits through automated surface monitoring and visual equipment inspections to avoid or identify early signs of integrity issues. Aera will install aboveground Automatic Shutoff Valves and Alarms that will be triggered by pressures beyond permitted operating limits that occur either upstream or

downstream of the valves and check valves to prevent flow in a direction opposite to the intended design. Aera will maintain wellbore integrity and isolation of CO_2 to the permitted injection zone by means of regular subsurface monitoring and logging.

4.1.5 Response Actions

Response actions to a loss of well integrity event will include the following:

- Initiate shutdown plan.
- Notify Belridge Producing Complex, On Duty Manager of Operations and/or On Duty Supervisor (s), using the Aera Pre-Incident Plan for Emergency Response as applicable.
- Notify the UIC Program Director and CARB Executive Officer within 24 hours of the emergency event per 40 CFR 146.91(c) and CCS Protocol C.6(b)(3), respectively. Notify other appropriate federal, state, and local agencies as necessary.
- Site supervisor or designee will perform an initial assessment of the situation and determine which additional project personnel should be notified.
- Determine the severity of the event, based on the information available, within 24 hours of notification.

If the situation is a Minor Emergency, response actions will include the following:

- Perform necessary repairs in consultation with the CARB Executive Officer and UIC Program Director.
- Confirm internal and external mechanical integrity has been restored according to protocols described in **Attachment E.**
- Restore injection operations in consultation with and upon receiving approval by the UIC Program Director and CARB Executive Officer.

If the situation is a Serious or Major Emergency, response actions will include the following:

- Initiate and staff an incident management team.
- Use appropriate equipment to measure CO_2 levels at ground surface, then isolate and restrict access to the project site, as needed.
- Continuously monitor the affected well(s) until the release is determined to be controlled.
- Perform subsurface investigations (e.g., well logging, fluid sampling) as appropriate to determine the cause and extent of the release.
- Perform remediation to affected freshwater aquifers, if required.
- Perform necessary repairs or plug affected well(s) in consultation with the CARB Executive Officer and UIC Program Director.
- If a well is repaired, perform the following:

- Confirm internal and external mechanical integrity have been restored according to protocols described in **Attachment E.**
- Restore injection operations in consultation with and upon receiving approval by the CARB Executive Officer and UIC Program Director.

Required equipment will be selected based on the event-specific evaluations performed and may include, but is not limited to, drilling rig, workover rig, or coiled tubing unit; wireline and logging equipment; slickline; and well control equipment.

4.1.6 Response Personnel

The following response personnel have contact information listed in the Aera Belridge Producing Complex Emergency Incident Placard and will be dispatched in case of a Major or Serious Emergency:

- Belridge Producing Complex, On Duty Manager of Operations and/or On Duty Supervisor(s)
- Belridge Critical Well Response Team
- Contractors including Patriot Environmental Service

4.2 Injection Well or Monitoring Equipment Failure

Failure of a well's injection or monitoring equipment could entail the loss of measurement(s) of wellhead pressure, temperature, and/or annulus pressure and may indicate a potential issue with the injection well. In serious cases, an injection equipment failure may constitute a wellhead release where CO_2 is released at the surface.

4.2.1 Potential Impacts

The potential consequence of an injection or monitoring equipment failure is the potential loss of data and the inability to demonstrate injection or monitoring well mechanical integrity. In severe cases, an injection or monitoring equipment failure may result in the release of CO_2 or formation fluids to the ground surface or atmosphere. In the case of a CO_2 release, effects would be localized and therefore pose the greatest risk to personnel in the immediate vicinity.

4.2.2 Event Identification and Characterization

Events will be identified and/or detected by observing anomalies in monitoring data as described in **Attachment E** and/or by visually inspecting operating equipment. Within 24 hours detecting a well equipment failure, the event will be classified by the following criteria:

- **Minor Emergency:** loss of sensor or monitoring data, but other data sources are sufficient to demonstrate mechanical integrity of wells and confirm wellhead and pipeline pressures.
- **Serious Emergency:** loss of sensor or monitoring data, and other data sources are not sufficient to demonstrate mechanical integrity of wells and confirm wellhead and pipeline pressures.

- **Major Emergency:** A wellhead release with CO_2 or formation fluids released at the surface.

4.2.3 Timing of event

Injection and post-injection phases.

4.2.4 Avoidance measures

Avoidance measures include regular site and equipment inspections and prompt maintenance, manned-remote monitoring, and equipment updates and calibration.

4.2.5 Response Actions

Response actions to an emergency event will include the following:

- Notify Belridge Producing Complex, On Duty Manager of Operations and/or On Duty Supervisor (s), using the Aera Pre-Incident Plan for Emergency Response as applicable.
- Notify the UIC Program Director and CARB Executive Officer within 24 hours of the emergency event per 40 CFR 146.91(c) and CCS Protocol C.6(b)(3), respectively. Notify other appropriate federal, state, and local agencies as required.
- Site supervisor or designee will perform an initial assessment of the situation and determine which additional project personnel should be notified.
- Determine the severity of the event, based on the information available, within 24 hours of notification.

If the situation is a Minor Emergency, perform necessary reset/repair or replacement of equipment.

If the situation is a Serious Emergency, perform the following:

- Initiate shutdown plan, in consultation with the UIC Program Director and CARB Executive Officer.
- Identify the location, nature, and extent of the failure; reset/repair, or replace sensor/monitoring devices; and/or confirm internal and external well integrity prior to restarting injection (upon approval of the UIC Program Director and CARB Executive Officer).
- If a loss of mechanical integrity is determined, use response actions described in **Section 4.1.3.**

If the situation is a Major Emergency, perform the following:

- Initiate and staff an incident management team.
- Initiate shutdown plan, in consultation with the UIC Program Director and CARB Executive Officer.
- Use appropriate equipment to measure CO_2 levels at ground surface, then isolate and restrict access to the project site, as needed.

- Perform surface investigations of wellheads, valves, and pipelines, as appropriate, to determine the cause and extent of the release.
- Perform necessary repairs in consultation with the CARB Executive Officer and UIC Program Director.
- Restore injection operations in consultation with and upon receiving approval by the CARB Executive Officer and UIC Program Director.

Required equipment will be selected based on the event-specific evaluations performed and may include nonspecialized equipment for monitor/sensor repair or replacement at the surface, at the wellhead, or in the well.

4.2.6 Response Personnel

The following response personnel have contact information listed in the Aera Belridge Producing Complex Emergency Incident Placard and will be dispatched in case of a Major or Serious Emergency.

- Belridge Producing Complex, On Duty Manager of Operations and/or On Duty Supervisor(s)
- Belridge Critical Well Response Team
- Contractors including Patriot Environmental Service

4.3 Potential Fluid (Brine) or CO_2 Leakage to Potential USDW

Potential CO_2 or formation fluid leakage to a potential freshwater aquifer, land surface, or atmosphere may be the result from a loss in well mechanical integrity, a major injection or monitoring well equipment failure, or a large seismic event. Fluid leakage may have occurred if elevated concentrations of indicator parameters are detected though logging and fluid sampling above the primary confining layer or by soil and vadose zone geochemical monitoring. Vegetation surveys, atmospheric leak monitoring, and visual inspections may also be used to detect leaks to the ground surface or atmosphere.

4.3.1 Potential Impacts

The potential consequence of CO_2 or formation fluid leakage to a potential freshwater aquifer, land surface or atmosphere include impacts to water quality and risks to the health and safety of personnel in the immediate vicinity of the leak.

4.3.2 Event Identification and Characterization

Events will be identified and/or detected by comprehensive monitoring detailed in **Attachment E**. "Emergency events" are categorized as shown in **Table 1**.

- **Minor Emergency:** evidence that fluid or CO_2 has potentially leaked from the sequestration zone into the overlying, oil-bearing, saline aquifers; no immediate risk to human health, resources, or infrastructure.

- **Serious Emergency:** evidence that fluid or CO_2 has potentially migrated from the sequestration zone into a potential USDW but poses no immediate risk to human health, resources, or infrastructure.
- **Major Emergency:** evidence that fluid or CO_2 has potentially migrated from the injection zone into a potential USDW and poses immediate risk to human health, resources, or infrastructure.

4.3.3 Timing of Event

Injection and post-injection phases.

4.3.4 Avoidance measures

Avoidance measures are discussed below:

- The project site has been carefully evaluated and is suitable for the project activities, as described in **Section 2.10** of the **Application Narrative**.
- Detailed evaluations of artificial penetrations within the AoR have been performed and necessary corrective actions will be performed prior to injection (**Attachment B**).
- Injection wells will operate within the established permit limits (**Section 7.1** of the **Application Narrative**).
- Rigorous monitoring will be performed during injection and post-injection phases (**Attachments E** and **G**).

4.3.5 Response Actions

Response actions to an emergency event will include the following:

- Initiate shutdown plan.
- Notify Belridge Producing Complex, On Duty Manager of Operations and/or On Duty Supervisor(s), using the Aera Pre-Incident Plan for Emergency Response as applicable.
- Notify the UIC Program Director and CARB Executive Officer within 24 hours of the emergency event per 40 CFR 146.91(c) and CCS Protocol C.6(b)(3), respectively. Notify other appropriate federal, state, and local agencies as required.
- Site supervisor or designee will perform an initial assessment of the situation and determine which additional project personnel should be notified.
- Determine the severity of the event, based on the information available, within 24 hours of notification.

If the situation is a Minor Emergency, perform the following:

- Determine the severity of the event, based on the information available, within 24 hours of notification.

- Perform subsurface investigations (e.g., well logging, geophysical surveys, fluid sampling, including installing additional groundwater monitoring points near the affected groundwater well(s) to delineate the extent of the impact) as appropriate, to determine the cause and extent of the release.
    - If a legacy well is found to be the source of the fluid leakage, perform corrective action in consultation with the UIC Program Director and CARB Executive Officer.
    - If an injection or monitoring well is found to be the source of the fluid leakage, plug well or perform necessary repairs in consultation with the CARB Executive Officer and UIC Program Director.
- Confirm internal and external mechanical integrity of affected well(s) has been restored according to protocols described in **Attachment E.**
- Restore injection operations in consultation with and upon receiving approval by the CARB Executive Officer and UIC Program Director.

If the situation is a Serious or Major Emergency, perform the following:

- Initiate and staff an incident management team.
- Use appropriate equipment to measure CO_2 levels at ground surface, then isolate and restrict access to the project site as needed.
- Continuously monitor the affected area(s) until the release is determined to be controlled.
- Perform subsurface investigations (e.g., well logging, geophysical surveys, fluid sampling, including installing additional groundwater monitoring points near the affected groundwater well(s) to delineate the extent of the impact) as appropriate, to determine the cause and extent of the release.
    - If a legacy well is found to be the source of the fluid leakage, perform corrective action in consultation with the UIC Program Director and CARB Executive Officer.
    - If an injection or monitoring well is found to be the source of the fluid leakage, use response actions described in **Section 4.1.3**.
- Perform remediation to affected freshwater aquifers, if required. Aera will continue groundwater remediation and monitoring on a frequent basis (frequency to be determined by Aera and the UIC Program Director) until unacceptable adverse USDW impacts have been fully addressed.
- If the potential USDW is utilized and has been caused to exceed drinking water standards, arrange for an alternate potable water supply. There are no water supply wells that produce from potential USDWs within the AoR.
- Restore injection operations in consultation with and upon receiving approval by the CARB Executive Officer and UIC Program Director.

Required equipment will be selected based on the event-specific evaluations performed and may include but is not limited to specialized equipment listed in **Section 4.1.3,** and additional nonspecialized equipment for groundwater/air sampling and remediation.

4.3.6 Response Personnel

The following response personnel have contact information listed in the Aera Belridge Producing Complex Emergency Incident Placard and will be dispatched in case of a Major or Serious Emergency.

- Belridge Producing Complex, On Duty Manager of Operations and/or On Duty Supervisor(s)
- Belridge Critical Well Response Team
- Contractors including Patriot Environmental Service

4.4 Natural Disaster

Natural events that could potentially occur at the project site include earthquakes, lightning strikes, and wildfires. Additional responses regarding earthquakes are defined by the operating thresholds described for Induced Seismic Events in **Section 4.5**.

4.4.1 Potential Impacts

Natural disasters occurring at the ground surface, such as lightning strikes and wildfires, have the potential to cause damage to aboveground facilities and operating equipment, resulting in a release of CO_2 to the ground surface or atmosphere. A natural seismic event may cause a loss of well integrity, damage to aboveground equipment, or fluid leakage above the confining zone and into potential USDWs. Natural disasters and any resulting impacts could pose risk to on-site personnel in the vicinity.

4.4.2 Event Identification and Characterization

Events will be identified and/or detected by visual and automatic shutoff valves and alarms. "Emergency events" are categorized as shown in **Table 1**.

- **Minor Emergency:** Small, contained event with little to no risk or interruption in operations.
- **Serious Emergency:** Fire, weather, or earthquake causing damage requiring operational shut down and/or causing significant damage to injection or monitoring equipment, including a loss of mechanical integrity.
- **Major Emergency:** Fire, weather, or earthquake causing leakage of CO_2 or formation fluids to a potential USDW.

4.4.3 Timing of event

Injection and post-injection phases.

4.4.4 Avoidance measures

Avoidance measures are discussed below.

- Grass or brush fire: create grass and brush clearance zones by clearing to bare soil zones of 2 to 3 feet (ft) for grass and 4 to 6 ft for medium brush around injection and observations wells
- Lightning: install lightning protection system, as appropriate

4.4.5 Response Actions

Response actions to an emergency event will include the following:

- Notify Belridge Producing Complex, On Duty Manager of Operations and/or On Duty Supervisor(s), using the Aera Pre-Incident Plan for Emergency Response as applicable.
- Notify the UIC Program Director and CARB Executive Officer within 24 hours of the emergency event per 40 CFR 146.91(c) and CCS Protocol C.6(b)(3), respectively. Notify other appropriate federal, state, and local agencies as required.
- Site supervisor or designee will perform an initial assessment of the situation and determine which additional project personnel should be notified.
- Determine the severity of the event, based on the information available, within 24 hours of notification.

If the situation is a Minor Emergency, perform the following:

- Coordinate with Belridge Producing Complex, On Duty Manager of Operations and/or On Duty Supervisor(s), using the Aera Pre-Incident Plan for Emergency Response as applicable.
- Perform necessary reset/repair or replacement of equipment, as needed.

If the situation is a Serious Emergency, perform the following:

- Initiate shutdown plan in consultation with the UIC Program Director and CARB Executive Officer.
- Perform necessary surface or subsurface investigations to identify the location, nature, and extent of the failure.
- If a well integrity failure is determined, use response actions described in **Section 4.1.3;** if a failure of injection or monitoring equipment is determined, use response actions described in **Section 4.2.3.**
- If contamination or endangerment is detected, identify and implement appropriate remedial actions in consultation with the UIC Program Director and CARB Executive Officer.
- Perform necessary repairs.
- Restore injection operations in consultation with and upon receiving approval by the UIC Program Director and CARB Executive Officer.

If the situation is a Major Emergency, perform the following:

- Initiate shutdown plan, in consultation with the UIC Program Director and CARB Executive Director.
- Initiate and staff an incident management team.
- Use appropriate equipment to measure CO_2 levels at ground surface, then isolate and restrict access to the project site, as needed.
- Continuously monitor the affected area(s) until the release is determined to be controlled.
- Perform necessary surface or subsurface investigations (e.g., inspections, well testing, geophysical surveys) to identify the location, nature, and extent of the failure(s).
    - If a well integrity failure is determined, use response actions described in **Section 4.1.3.**
    - If a failure of injection or monitoring equipment is determined, use response actions described in **Section 4.2.3**.
    - If a leak of CO_2 or formation fluid leakage to a potential freshwater aquifer, land surface, or atmosphere is identified, follow response actions in **Section 4.3.3.**
- Perform remediation to affected freshwater aquifers, if required. Aera will continue groundwater remediation and monitoring on a frequent basis (frequency to be determined by Aera and the UIC Program Director) until unacceptable adverse USDW impacts have been fully addressed.
- If the potential USDW is utilized and has been caused to exceed drinking water standards, arrange for an alternate potable water supply. There are no water supply wells that produce from potential USDWs within the AoR.
- Restore injection operations in consultation with and upon receiving approval by the CARB Executive Officer and UIC Program Director.

Required equipment will be selected based on the event-specific evaluations performed and may include nonspecialized equipment for repair or replacement of damaged equipment at the surface and at the wellhead, as well as nonspecialized equipment for groundwater sampling and remediation.

4.4.6 Response Personnel

The following response personnel have contact information listed in the Aera Belridge Producing Complex Emergency Incident Placard and will be dispatched in case of a Major or Serious Emergency:

- Belridge Producing Complex, On Duty Manager of Operations and/or On Duty Supervisor(s)
- Belridge Critical Well Response Team
- Contractors including Patriot Environmental Service

4.5 Induced Seismic Event

Induced seismic events are earthquakes caused by pressure changes associated with injection operations. The fault stability analysis and appropriate operating conditions as described in **Sections 2.3** and **7.1** of the **Application Narrative** demonstrate that the proposed operating parameters are not predicted to cause a seismic event; however, response actions to an event of this type are considered here. Natural earthquakes may be difficult to distinguish from induced seismic events without subsequent investigation; therefore, response actions described here will apply to any earthquake with an epicenter within a 10 mi radius of an injection well.

4.5.1 Potential Impacts

A small-scale induced seismic event, with magnitude (M) ≤ M 2.5, is unlikely to cause damage to project infrastructure or pose immediate risk to personnel in the vicinity. A large event with strong ground shaking, though unlikely to occur, has the potential to lead to well integrity failure(s), well injection or monitoring equipment failure(s), or fluid leakage to potential freshwater aquifers, the ground surface, or atmosphere. A large seismic event could also pose risk to on-site personnel in the vicinity.

4.5.2 Event Identification and Characterization

Aera will conduct periodic monitoring and analysis of the Southern California Earthquake Data Center (SCEDC) reporting data of earthquakes with moment magnitude > 1, local reporting of felt events, local observations, and reports of damage caused by seismic activity within the AoR. Continuous microseismic monitoring will also be performed using the seismic monitoring network as described in **Attachment E**. Event identification and characterization based on threshold conditions are shown in **Table 2**. Threshold conditions for determining operating conditions are defined by the following:

- Specified magnitudes refer to magnitudes determined by local SCEDC or USGS seismic monitoring stations or reported by the USGS National Earthquake Information Center using the national seismic network.
- "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.
- 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.

Severity of an induced seismic event will be categorized by the following criteria:

- **Minor:** Operating State YELLOW (five or more seismic events with 30 days >M1.5 but ≤M2.0) and Operating State ORANGE (seismic event >M1.5 with local observation or felt report, or >2.0 but no local observation or felt report)
- **Serious:** Operating State MAGENTA (seismic events > M2.0 with felt report or local observation)

- **Major:** Operating State RED (seismic event > M2.0 with local observation or felt report and confirmation of damage, or seismic event >3.5)

4.5.3 Timing of event

Injection and post injection phases.

4.5.4 Avoidance measures

Avoidance measures include fault stability analysis and appropriate operating conditions as described in **Sections 2.3** and **7.1** of the **Application Narrative**, and microseismic monitoring as described in the Testing and Monitoring Plan (**Attachment E**).

4.5.5 Response Actions

Aera will use the Seismic Response System structure presented in **Table 2** to assign an operating state based on data obtained from the SCEDC catalog and microseismic monitoring and follow the corresponding response actions.

Required equipment will be selected based on the event-specific evaluations performed and may include nonspecialized equipment for repairs or replacement at the surface, at the wellhead, and in the well, as well as nonspecialized equipment for groundwater sampling and remediation.

4.5.6 Response Personnel

The following response personnel have contact information listed in the Aera Belridge Producing Complex Emergency Incident Placard and will be dispatched in case of a Major or Serious Emergency.

- Belridge Producing Complex, On Duty Manager of Operations and/or On Duty Supervisor(s)
- Belridge Critical Well Response Team
- Contractors including Patriot Environmental Service

Table 2: Seismic Response System for Seismic Events > M1.0 with an Epicenter within a 2.0-Mi. Radius of an Injection Well

Operating Level		Threshold Conditions	Response Actions
Green		Seismic events with magnitude ≤ M1.5	1. Continue normal operation within permitted levels. 2. Document the event in semiannual reports to the EPA.
Yellow		Five (5) or more seismic events within a 30-day period having a magnitude > M1.5 but ≤ M2.0	1. Continue normal operation within permitted levels. 2. Notify Belridge Producing Complex, On Duty Manager of Operations and/or On Duty Supervisor(s), using the Aera Pre-Incident Plan for Emergency Response as applicable. 3. Within 24 hours of the incident, notify the UIC Program Director and CARB Executive Officer of the operating status of the well(s). Consult with the UIC Program Director and CARB Executive Officer on next steps. 4. Initiate gradual shutdown of the well(s) if it is determined appropriate. 5. Review seismic and operational data to determine location and magnitude of seismic events. If an event falls near the extents of the plume, estimate potential impacts to USDWs. 6. Perform a pressure falloff test to identify whether any changes to formation pressure or injectivity occurred and determine if the storage complex has been compromised by the seismic event. 7. Following evaluation, determine whether normal operations can continue. 8. Following a change in operating state, report findings to the UIC Program Director within 25 business days. 9. Document the event in semiannual reports to the EPA.
Orange		Seismic events > M1.5 and ≤ M2.0 with felt report or local observation Or Seismic event > M2.0 and no felt report or local observation	1. Continue normal operation within permitted levels. 2. Notify Belridge Producing Complex, On Duty Manager of Operations and/or On Duty Supervisor(s), using the Aera Pre-Incident Plan for Emergency Response as applicable. 3. Within 24 hours of the incident, notify the UIC Program Director and CARB Executive Officer of the operating status of the well(s). Consult with the UIC Program Director and CARB Executive Officer on next steps. 4. Initiate gradual shutdown of the well(s) if it is determined appropriate. 5. Review seismic and operational data to determine location and magnitude of seismic events. If an event falls near the extents of the plume, estimate potential impacts to USDWs. 6. Perform a pressure falloff test to identify whether any changes to formation pressure or injectivity occurred and determine if the storage complex has been compromised by the seismic event. 7. Following evaluations, determine whether normal operations can continue in consultation with the UIC Program Director. 8. Report findings to the UIC Program Director within 25 business days. 9. Document the event in semiannual reports to the EPA.

Operating Level		Threshold Conditions	Response Actions
Magenta		Seismic event > M2.0 with local observation or felt report	1. Initiate shutdown plan. 2. Notify Belridge Producing Complex, On Duty Manager of Operations and/or On Duty Supervisor(s), using the Aera Pre-Incident Plan for Emergency Response as applicable. 3. Within 24 hours of the incident, notify the UIC Program Director and CARB Executive Officer of the operating status of the well(s). Consult with the UIC Program Director and CARB Executive Officer on next steps. 4. Vent CO_2 from surface facilities. 5. Limit access to wellhead(s) to authorized personnel only. 6. Communicate with facility personnel and local authorities to initiate evacuation plans, as necessary. 7. Monitor well(s) pressure, temperature, and annulus pressure to verify well(s) status and determine the cause and extent of any failure; identify and implement appropriate remedial actions (in consultation with the UIC Program Director). 8. Review seismic and operational data to determine location and magnitude of seismic event. If the event falls near the extents of the plume, estimate potential impacts to USDWs. 9. Perform a pressure falloff test to identify whether any changes to formation pressure or injectivity occurred and determine if the storage complex has been compromised by the seismic event. 10. Determine if leaks to ground water or surface water occurred. 11. If USDW contamination is detected, endangerment or CO2 leaked: a. Notify the UIC Program Director within 24 hours of the determination. b. Contact environmental and geotechnical professionals for expertise and advice. 12. Following evaluations, determine whether normal operations can continue in consultation with the UIC Program Director. 13. Assess monitoring plans and where necessary intensify the monitoring plan to ensure containment. 14. Report findings to the UIC Program Director within 25 business days and perform corrective actions. 15. Document the event in semiannual reports to the EPA.
Red		Seismic event > M2.0 with local observation or felt report, and local report and confirmation of damage Or Seismic event >3.5	1. Initiate shutdown plan. 2. Notify Belridge Producing Complex, On Duty Manager of Operations and/or On Duty Supervisor(s), using the Aera Pre-Incident Plan for Emergency Response as applicable. 3. Within 24 hours of the incident, notify the UIC Program Director and CARB Executive Officer of the operating status of the well(s). Consult with the UIC Program Director and CARB Executive Officer on next steps. 4. Vent CO_2 from surface facilities. 5. Limit access to wellhead(s) to authorized personnel only. 6. Communicate with facility personnel and local authorities to initiate evacuation plans, as necessary. 7. Monitor well(s) pressure, temperature, and annulus pressure to verify well(s) status and determine the cause and extent of any failure; identify and implement appropriate remedial actions (in consultation with the UIC Program Director).

Operating Level	Threshold Conditions	Response Actions
		8. Review seismic and operational data to determine location and magnitude of seismic event. If the event falls near the extents of the plume, estimate potential impacts to USDWs. 9. Perform a pressure falloff test to identify whether any changes to formation pressure or injectivity occurred and determine if the storage complex has been compromised by the seismic event. 10. Determine if leaks to ground water or surface water occurred. 11. If USDW contamination is detected, endangerment or CO_2 leaked: a. Notify the UIC Program Director within 24 hours of the determination. b. Contact environmental and geotechnical professionals for expertise and advice. 12. Following evaluations, determine whether normal operations can continue in consultation with the UIC Program Director. 13. Assess monitoring plans and where necessary intensify the monitoring plan to ensure containment. 14. Report findings to the UIC Program Director within 25 business days and perform corrective actions. 15. Document the event in semiannual reports to the EPA.

5. EMERGENCY COMMUNICATIONS PLAN

The following response personnel have contact information listed in the Belridge Producing Complex Emergency Incident Placard and will be dispatched in case of a Major or Serious Emergency.

- Belridge Producing Complex, On Duty Manager of Operations and/or On Duty Supervisor(s) (see placard for contact phone number)
- Belridge Critical Well Response Team: (661) 765-1133, 24-hour (800) 247-5977
- Contractors including Patriot Environmental Service: (800) 624-9136
- Public and Media Liaison: (661) 665-5627

The site-specific emergency contact list in **Table 3** will be maintained on site and updated as appropriate during the life of the project.

Table 3: Contact Information for Key Local, State, and Other Authorities

Organization	Phone Number
Trans West (dispatches Emergency Response (ER) Teams and connects to Kern County services (Sheriff & Fire Dept.)	(661) 765-4450
Kern County Sheriff	(661) 862-8740
Kern County Fire Dept.	(877) 237-2911 (877-AERA-911) (emergency) (661) 324-6551 (non-emergency)
California Governor's Office of Emergency Services Warning Center (Cal OES)	(800) 852-7550
Patriot Environmental Service	(800) 624-9136
UIC Program Director	(415) 972-3971
EPA National Response Center (24 hours)	(800) 424-8802
CARB Executive Officer	(800) 242-4450
California Geological Survey	(916) 445-1825
California Highway Patrol (Bakersfield, CA)	(661) 764-5580

Aera will communicate with appropriate members of the public who may be affected by an emergency event. Aera will communicate 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. The amount of information, timing, and communications method(s) will be appropriate to the event and its severity, and will include event description, potential impacts to the environment or other local resources, investigation summary, response actions, and status. Aera will provide periodic updates as necessary.

If necessary, Aera will also communicate with entities who may need to be informed about or act in response to the event, including local water purveyors or operators, CO_2 suppliers, pipeline

operators, oil and gas operators, landowners, and other departments/authorities as guided by the CARB Executive Officer and UIC Program Director.

6. EMERGENCY AND REMEDIAL RESPONSE PLAN REVIEW TIMELINE

This ERRP shall be reviewed:

- At least once every 5 years following its approval by the CARB Executive Officer and UIC Director;
- Within one year of an AoR reevaluation;
- Within 30 days following significant changes to the injection process or the injection facility, or a Serious or Major Emergency; or,
- As required by the CARB Executive Officer and UIC Director.

If the review indicates that no amendments to the ERRP are necessary, Aera will provide the EPA with the documentation supporting the "no amendment necessary" determination.

If the review indicates that amendments to the ERRP are necessary, amendments shall be made and submitted to the EPA within 120 days following an event that initiates the ERRP review procedure.

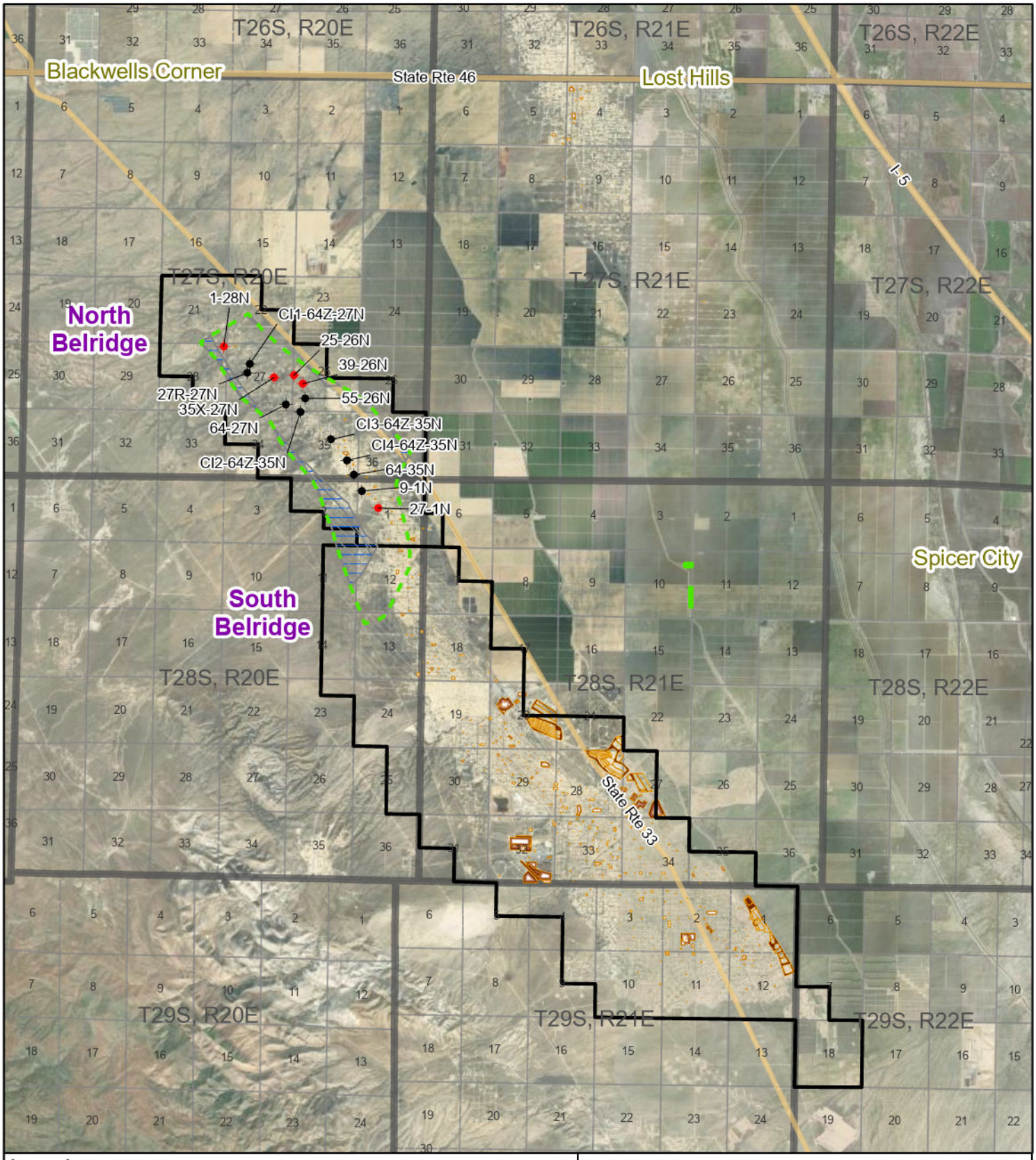
7. STAFF TRAINING AND EXERCISE PROCEDURES

Aera facility staff and contractors working at the Aera CCS Facility or within the AoR may require training depending on project role and activities. This may include, but not be limited to, the following:

- Incident Command System Training
- CO_2 Facilities Training
- CO_2 Safety Training
- CO_2 Hazards Training
- Emergency Response Training

Training will be conducted prior to field deployment and refreshed annually.

Figures



Legend

Class VI Wells

- Injection Well
- Monitoring Well
- Area of Review
- Potential Fresh Water Aquifers Within the Storage Complex
- North/South Belridge Administrative Boundary
- Facilities/Building Infrastructure
- Township
- Housing Tract
- Section

N

0 2 Miles

Aera North Belridge Oil Field
Resources and Infrastructure
North Belridge Oil Field
Western Kern County
California

Geosyntec consultants

CarbonFrontier	April 2024

Figure 1

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