ATTACHMENT F: EMERGENCY AND REMEDIAL RESPONSE PLAN
40 CFR 146.94(a)
CTV VI

Document Version History

Version	Revision Date	File Name	Description of Change
1	7/31/2024	Att F - CTV VI ERR_v1	Original Submission

1. Facility Information

Facility Name: CTV VI

Facility Contact: Faisal Latif, Storage Development Manager
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Location: Claimed as PBI

This Emergency and Remedial Response Plan (ERRP) describes actions that Carbon TerraVault Holdings, LLC (CTV) 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.

The ERRP would be implemented in response to events that could be detected in the course of monitoring pursuant to **Attachment C: Testing and Monitoring Plan** (**Attachment C**), including exceedances of Actionable Testing limits described in Table 7 of **Appendix 10**: **Quality Assurance and Surveillance Plan (QASP)** (**Appendix 10**).

If CTV obtains evidence that the injected carbon dioxide (CO_2) stream and/or associated pressure front may cause an endangerment to a USDW, CTV must perform the following actions:

- Initiate shutdown plan for the injection well.
- Take all steps reasonably necessary to identify and characterize any release.
- Notify the permitting agency (UIC Program Director) of the emergency event within 24 hours.
- Implement applicable portions of the approved ERRP.

Where the phrase "initiate shutdown plan" is used, the following protocol will be employed: CTV will immediately cease injection. However, in some circumstances, CTV will, in consultation with the UIC Program Director, determine whether gradual cessation of injection (using the parameters set forth in **Attachment A** of the Class VI permit) is appropriate.

2. Local Resources and Infrastructure

Resources in the vicinity of the CTV facility that may be affected as a result of an emergency event at the project site include:

- A base of fresh water and USDW exist in the project area. The measured depth of the base of fresh water is Claimed as PBI The measured depth of the base of the USDW is between Claimed as PBI
- Claimed as PBI exist inside the project Area of Review (AoR).

Resources and infrastructure addressed in this plan are shown in **Figure F-1**.

3. Potential Risk Scenarios

The following events related to the CTV facility could potentially result in an emergency response:

- Well integrity failure
- Injection well or monitoring well equipment failure (e.g., shut-off valve or pressure gauge, etc.)
- A natural disaster (e.g., earthquake, tornado, lightning strike, flooding)
- Potential brine or CO_2 leakage to a USDW
- CO_2 leakage to a USDW or land surface
- Induced or natural seismic event

Response actions will depend on the severity of the event(s) triggering an emergency response. "Emergency events" are categorized as shown in **Table F-1**.

4. Emergency Identification and Response Actions

Steps to identify and characterize the event will be dependent on the specific issue identified, and the severity of the event. The potential risk scenarios identified in Part 2 are detailed below.

4.1 Well Integrity Failure

Integrity loss at an injection well and/or verification well may endanger USDWs. Pursuant to 40 CFR 146.91(c)(3), CTV must notify the UIC Program Director within 24 hours of any triggering of a shut-off system (i.e., downhole or at the service).

Integrity loss may have occurred if the following events occur:

- Automatic shutdown devices are activated:
  - Wellhead pressure exceeds the shutdown pressure specified in the permit.
  - Annulus pressure indicates a loss of external or internal well containment.

- Pursuant to 40 CFR 146.91(c)(3), CTV must notify the UIC Program Director within 24 hours of any triggering of a shut-off system (i.e., downhole or at the service).

- Mechanical integrity test results identify a loss of mechanical integrity.

Severity: Low to moderate, dependent on the magnitude of the event.

Timing of event: Injection/monitoring.

Avoidance measures: Well maintenance, monitoring and control of injection flow and pressure.

Detection methods: Mechanical integrity testing, monitoring for unexpected changes in injection well pressures and rates, annulus pressure increase, and visual (CO_2 at surface).

Potential response actions:

- Notify the plant superintendent and project manager.
- Limit access to wellhead to authorized personnel only.
- Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).
- Determine the severity of the event, based on the information available, within 24 hours of notification.
- For a Major or Serious emergency (loss or increase of pressure or fluid volumes and/or loss of mechanical integrity during testing and maintenance):
  - Contact security to restrict access to the storage site.
  - Initiate shutdown plan.
  - Shut-in injection well and vent CO_2 from surface facilities.
  - Communicate with CTV personnel and local authorities to initiate evacuation plans, as necessary.
  - Continuously monitor well pressure, temperature, and annulus pressure to assess integrity loss and determine the root cause of failure.
  - If contamination is detected, identify, and implement appropriate remedial actions (in consultation with the UIC Program Director).
  - If there is damage to the wellhead, repair the damage and conduct a survey to ensure that leakage has ceased.
  - Preform a well log/mechanical integrity test (MIT) to detect CO_2 movement outside of the casing.
  - Confirm well integrity prior to restarting injection (upon approval of the UIC Program Director).
- For a Minor emergency (downhole and surface sensor/monitoring equipment failure):
  - Conduct assessment to determine whether there has been a loss of mechanical integrity.

- If there has been a loss of mechanical integrity, initiate shutdown plan.
- Contact security to restrict access to the storage site.
- Initiate shutdown plan.
- Shut-in injection well and vent CO_2 from surface facilities.
- Continuously monitor well pressure, temperature, and annulus pressure to assess integrity loss and determine the root cause of failure.
- If contamination is detected, identify, and implement appropriate remedial actions (in consultation with the UIC Program Director).
- If there is damage to the wellhead, repair the damage and conduct a survey to ensure that leakage has ceased.
- Preform a well log/MIT to detect CO_2 movement outside of the casing.
- Confirm well integrity prior to restarting injection (upon approval of the UIC Program Director).

Response personnel: Emergency response personnel, drilling crew, geotechnical professionals, and environmental or water treatment professionals.

Equipment: Drill rig, logging equipment, cement or casing, and air and water testing equipment.

4.2 Injection Well Monitoring Equipment Failure

The failure of monitoring equipment for wellhead pressure, temperature, and/or annulus pressure may indicate a problem with the injection well that could endanger USDWs.

Severity: Low

Timing of event: Injection

Avoidance measures: Well maintenance, and careful monitoring and control of injection flow and pressure.

Detection methods: Anomalies in monitoring data, and visual failure of equipment.

Potential response actions:

- Notify the plant superintendent and project manager.
- Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).
- Determine the severity of the event, based on the information available, within 24 hours of notification.
- For a Major or Serious emergency (failure of sensors that will require shutdown of well to repair, requires extended repair time (>48 hours) and/or well intervention to remediate):

- Contact security to restrict access to the storage site.
- Communicate with CTV personnel and local authorities to isolate the area and initiate evacuation plans, as necessary.
- Initiate shutdown plan.
- Shut-in injection well and vent CO_2 from surface facilities.
- Manually collect surface tubing pressure and annulus pressure as needed to monitor the well until monitoring equipment is repaired.
- Identify and, if necessary, implement appropriate remedial actions (in consultation with the UIC Program Director).
- Verify whether contamination has occurred via handheld CO_2 monitors.
- Confirm well integrity prior to restarting injection and upon approval of the UIC Program Director.

- For a Minor emergency (sensor or monitoring failure that does not require shutdown of the well to repair):
  - Conduct assessment to determine whether there has been a loss of mechanical integrity.
  - If there has been a loss of mechanical integrity, initiate shutdown plan and refer to Major or Serious emergency guidelines.
  - Evaluate the cause of failure, and mitigate if necessary (i.e., repair equipment).
  - Contact security to restrict access to the Storage site.
  - Shut-in injection well and vent CO_2 from surface facilities.
  - Continuously monitor well pressure, temperature, and annulus pressure to assess integrity loss and determine the root cause of failure.
  - Confirm well integrity prior to restarting injection and upon approval of the UIC Program Director.

Response Personnel: Emergency response personnel, drilling crew, geotechnical professionals, and environmental or water treatment professionals.

Equipment: Drill rig, logging equipment, cement or casing, and air and water testing equipment.

4.3 Potential Brine or CO_2 Leakage to USDW

Elevated concentrations of indicator parameter(s) in groundwater sample(s) or other evidence of fluid (brine) or CO_2 leakage into a USDW.

Severity: Serious

Timing of event: Injection

Avoidance measures: CTV will operate the project to ensure containment of CO_2. Contamination to USDWs will be avoided by:

- Ensuring injection well integrity through well maintenance and MIT.
- Maintaining the injection pressure below the fracture gradient of the confining layer and assessing data from seismic monitoring to ensure competency of the confining layer.
- Reviewing monitoring well data to understand plume extent.
- Monitoring of the dissipation interval that overlies the confining layer to establish leakage before migration to USDW.

Detection methods: Pressure change in dissipation interval or pressure or water composition change in the USDW monitoring wells.

Potential response actions:

- Notify the plant superintendent and project manager.
- Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).
- Determine the severity of the event, based on the information available, within 24 hours of notification.
- For all emergencies (Major, Serious, or Minor):
  - Initiate shutdown plan.
  - Contact security to restrict access to the storage site.
  - Shut-in injection well and vent CO_2 from surface facilities.
  - If the presence of indicator parameters is confirmed, develop (in consultation with the UIC Program Director) a case-specific work plan to:
  - Install additional groundwater monitoring points near the affected groundwater well(s) to delineate the extent of impact; and
  - Remediate unacceptable impacts to the affected USDW.
  - Arrange for an alternate potable water supply, if the USDW was being utilized and has been caused to exceed drinking water standards.
  - 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).
  - Continue groundwater remediation and monitoring on a frequent basis (frequency to be determined by CTV and the UIC Program Director) until unacceptable adverse USDW impact has been fully addressed.
  - If there is a well integrity issue, refer to the Mechanical Integrity Failure scenario.

- If the leak poses a risk to air quality a perimeter will be established via hand-held air monitoring devices.

Response personnel: Emergency response personnel, drilling crew, geotechnical professionals, and environmental or water treatment professionals.

Equipment: Drill rig, logging equipment, groundwater remediation equipment, cement or casing, and air and water testing equipment.

4.4 Natural Disaster

Well problems (integrity loss, leakage, or malfunction) may arise as a result of a natural disaster affecting the normal operation of the injection well. An earthquake may disturb surface and/or subsurface facilities; and weather-related disasters (e.g., tornado, flooding, or lightning strike) may affect surface facilities.

If a natural disaster occurs that affects normal operation of the injection well, CTV will perform the following.

*Severity***:** Serious to catastrophic

Timing of event: Pre-injection, injection, and/or post injection phases.

Avoidance measures: N/A

Detection methods: N/A

Potential response actions:

- Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).
- Determine the severity of the event, based on the information available, within 24 hours of notification.
- For a Major or Serious emergency:
  - Initiate shutdown plan.
  - Contact security to restrict access to the storage site.
  - Shut-in injection well and vent CO_2 from surface facilities.
  - Continuously monitor well pressure, temperature, and annulus pressure to assess integrity loss and determine the root cause of failure.
  - If contamination has occurred refer to the Potential Brine or CO_2 Leakage to USDW scenario.
  - Communicate with CTV personnel and local authorities to initiate evacuation procedures.

- If there is a well integrity issue for the injector or monitoring well, refer to the Mechanical Integrity Failure scenario.
- If contamination or endangerment is detected, identify, and implement appropriate remedial actions (in consultation with the UIC Program Director).

- For a Minor emergency:
  - Conduct assessment to determine whether there has been a loss of mechanical integrity.
  - If there has been a loss of mechanical integrity, initiate shutdown plan.
  - Contact security to restrict access to the Storage site.
  - Shut-in injection well and vent CO_2 from surface facilities.
  - Continuously monitor well pressure, temperature, and annulus pressure to assess integrity loss and determine the root cause of failure.

Response personnel: Emergency response personnel, drilling crew, geotechnical professionals, and environmental or water treatment professionals.

Equipment: Drill rig, logging equipment, cement or casing and air and water testing equipment.

4.5 Induced or Natural Seismic Event

Based on the project operating conditions, it is highly unlikely that injection operations would ever induce a seismic event outside the AoR. Therefore, this portion of the response plan is developed for any seismic event with an epicenter within the AoR, inclusive of a 2-mile buffer.

To monitor the area for seismicity, CTV will install surface and shallow borehole seismometers to continuously record the site for seismic activity.

Severity: Major

Timing of event: Injection or post injection phases. An induced seismic event will occur when the reservoir stresses are altered, which would occur during the injection phase.

Avoidance measures: N/A

Detection methods: The seismic monitoring network.

Potential response actions: 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 F-2**. The table corresponds each level of operating state with the threshold conditions and operational response actions.

Response personnel: Emergency response personnel, California Geological Survey, drilling crew, geotechnical professionals, and environmental or water treatment professionals.

Equipment: Depending on the operating state drill rig, logging equipment, cement or casing and air and water testing equipment.

5. Response Personnel and Equipment

Site personnel, project personnel, and local authorities will be relied upon to implement this ERRP.

Site personnel to be notified (not listed in order of notification):

1. Project Manager
   Faisal Latif (661- 623-1824)
2. Field Manager
   David Hauptman (661-858-3864)
3. Environmental Manager
   Brian Pellens (661-321-6240)
4. Security and Emergency Response Director (24-hour contact)
   Bill Blair (562-743-8336)
5. Public and Media Liaison
   Joe Ashley (661-301-6551)

A site-specific emergency contact list will be developed and maintained during the life of the project. CTV will provide the current site-specific emergency contact list to the UIC Program Director. Equipment needed in the event of an emergency and remedial response will vary, depending on the triggering emergency event. Response actions (cessation of injection, well shut-in, and evacuation) will generally not require specialized equipment to implement. Where specialized equipment (such as a drilling rig or logging equipment) is required, CTV shall be responsible for its procurement.

6. Emergency Communications Plan

CTV will communicate to the public about any event that requires an emergency response to ensure that the public understands what happened and whether or not there are any environmental or safety implications. Communication timing and format(s) will be tailored to the specific event depending on its severity, and any impacts to drinking water, other environmental resources, or the surrounding community. CTV will describe what happened, any impacts to the environment or other local resources, how the event was investigated, what responses were taken, and the status of the response. For responses that occur over the long-term (e.g., ongoing cleanups), CTV will provide periodic updates on the progress of the response action(s).

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

Table F-3 lists contact information for key local, state and other authorities.

7. Plan Review

This ERRP shall be reviewed:

- At least once every five years following its approval by the permitting agency
- Within one year of an AoR reevaluation
- Within 30 days, or other time prescribed by the EPA director, following any significant changes to the injection process or the injection facility, or an emergency event;
- As required by the permitting agency

If the review indicates that no amendments to the ERRP are necessary, CTV will provide the permitting agency 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 permitting agency within three months following an event that initiates the ERRP review procedure.

8. Staff Training and Exercise Procedures

All CTV staff and contractors operating at the CO_2 sequestration facilites, or working in the AoR will be subjected to the following training either prior to deployment in the field or annually:

- CO_2 Facilities Training
  - On-site and classroom training for facility and infrastructure security, maintainence, and operations.
- CO_2 Safety Training
  - Carbon dioxide detection equipment: Operation and maintainence of personal monitors, portable multi-gas monitors and stationary montiors throughout the facility.
  - Carbon dioxide hazards: Accidental exposure, adverse health effects, workplace exposure limits and first aid.
  - Emergency response: Training in the event of CO_2 leakage and exersise and drills simulating potential emergency situations.

Figures

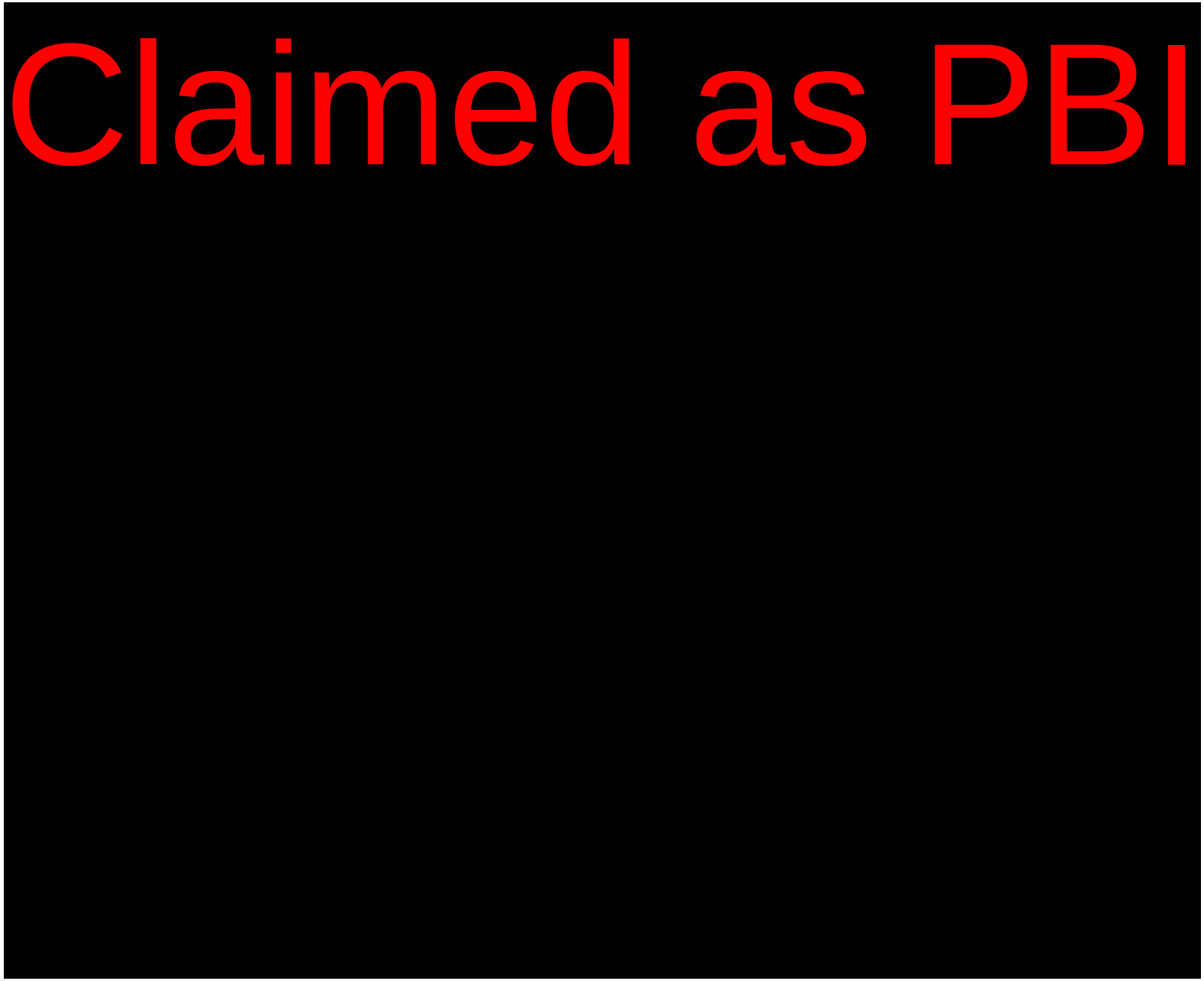

Figure F-1. Map of the Site Resources and Infrastructure.

Tables

Table F-1. Degrees of Risk for Emergency Events

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

Table F-2. Seismic Monitoring System for Seismic Events > M1.5 with an Epicenter Within a 2-mile Radius of the Injection Well, Page 1 of 2

Operating State	Threshold Condition [a,b]	Response Action [c]
Green	Seismic events less than or equal to M1.5	1. Continue normal operation within permitted levels. 2. Document the event in semiannual reports to the EPA.
Yellow	Five 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. 2. Initiate gradual shutdown of the well if it is determined appropriate. 3. 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. Perform a pressure fall-off test to determine if the storage complex has been compromised by the seismic event. 4. Within 24 hours of the incident, notify the UIC Program Director of the operating status of the well. 5. Document the event in semiannual reports to the EPA.
Orange	Seismic event greater than M1.5 and local observation or felt report Seismic event greater than M2.0 and felt report	1. Continue normal operation within permitted levels. 2. Initiate gradual shutdown of the well if it is determined appropriate. 3. 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. Perform a pressure falloff test to determine if the storage complex has been compromised by the seismic event. 4. Within 24 hours of the incident, notify the UIC Program Director, of the operating status of the well. 5. Report findings to the UIC Program Director and issue corrective actions. 6. Document the event in semiannual reports to the EPA
Magenta	Seismic event greater than M2.0 and local observation or report	1. Initiate rate reduction plan. 2. Vent CO_2 from surface facilities. 3. Within 24 hours of the incident, notify the UIC Program Director, of the operating status of the well. 4. Limit access to wellhead to authorized personnel only. 5. Communicate with facility personnel and local authorities to initiate evacuation plans, as necessary. 6. Monitor well pressure, temperature, and annulus pressure to verify well status and determine the cause and extent of any failure; identify and implement appropriate remedial actions (in consultation with the UIC Program Director). 7. Determine if leaks to ground water or surface water occurred. 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. Perform a pressure falloff test to determine if the storage complex has been compromised by the seismic event. 9. If USDW contamination is detected, endangerment and 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. 10. Assess monitoring plans and where necessary intensify the monitoring plan to ensure containment. 11. Report findings to the UIC Program Director and issue corrective actions. 12. Document the event in semiannual reports to the EPA.

Table F-2. Seismic Monitoring System for Seismic Events > M1.5 with an Epicenter Within a 2-mile Radius of the Injection Well, Page 2 of 2

Operating State	Threshold Condition [a,b]	Response Action [c]
Red	Seismic event greater than M2.0, and local observation or report, and local report and confirmation of damage [d] Or Seismic event >M3.5	1. Initiate shutdown plan. 2. Vent CO_2 from surface facilities. 3. Communicate with facility personnel and local authorities to initiate evacuation plans, as necessary. Within 24 hours of the incident, notify the UIC Program Director of the operating status of the well. .Limit access to wellhead to authorized personnel only. 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). 5. 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. Perform a pressure falloff test to determine if the storage complex has been compromised by the seismic event. 6. Determine if leaks to ground water or surface water occurred. 7. If USDW contamination is detected, endangerment and 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. 8. Review seismic and operational data. 9. Report findings to the UIC Program Director and issue corrective actions. 10. Document the event in semiannual reports to the EPA.

[a] Specified magnitudes refer to magnitudes determined by local Southern California Earthquake Data Center or USGS seismic monitoring stations or reported by the USGS National Earthquake Information Center using the national seismic network.

[b] "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.

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

[d] 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.

Table F-3. Contact Information for Key Local, State, and Other Authorities

Agency	Phone Number
Fresno County Sheriff	9-1-1 (Emergency) (559) 600-3111 (Non-emergency)
California Governor's Office of Emergency Services (Cal OES)	(916) 845-8506
UIC Program Director (EPA)	415 972-3971 Albright.David@epa.gov
EPA National Response Center (24 hours)	800-424-8802
California Geological Survey	(916) 322-1080
Cal-Fire/Fresno County Fire District	9-1-1 (Emergency) (559) 485-7500 (Non-emergency)
California Air Resources Board (CARB)	800-242-4450
Poison Control Center	800-342-9293
California Office of Emergency Services (24 hours)	800-852-7550
State Water Quality Control Board (Central Valley)	(916) 255-3000