

CLASS VI INJECTION EMERGENCY REMEDIAL RESPONSE PLAN

40 CFR 146.94

TRILLIUM CARBON STORAGE COMPLEX (TCSC)

Facility Information

Facility Name: Trillium Carbon Storage Complex (TCSC)
TCSC-1 , TCSC-2, TCSC-3, TCSC-4, TCSC-5

Facility Contact: Claimed as PBI
[Redacted]
[Redacted]
[Redacted]

Facility Address: [Redacted]

Well Locations: Claimed as PBI [Redacted] [Redacted]

Well Name	Latitude	Longitude
TCSC-1	Claimed as PBI	[Redacted]
TCSC-2	Claimed as PBI	[Redacted]
TCSC-3	Claimed as PBI	[Redacted]
TCSC-4	Claimed as PBI	[Redacted]
TCSC-5	Claimed as PBI	[Redacted]

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Abbreviations and Acronyms

AoR	Area of Review
API	American Petroleum Institute
CO ₂	Carbon Dioxide
ERRP	Emergency and Remedial Response Plan
HAZCOM	HAZard COMmunication
OSHA	Occupational Safety and Health Administration
PISC	Post-Injection Site Care
RAM	Risk Assessment Matrix
TCSC	Trillium Carbon Storage Complex
TMP	Testing and Monitoring Plan
Trillium	Trillium Piketon, LLC
UIC	Underground Injection Control
USDW	Underground Source of Drinking Water

10. EMERGENCY AND REMEDIAL RESPONSE PLAN

The purpose of this Emergency and Remedial Response Plan (ERRP) is to meet the federal requirements of 40 CFR 146.94 under the Underground Injection Control (UIC) Class VI Permit Guidelines. This plan covers five proposed injection wells at the Trillium Carbon Storage Complex (TCSC) **Claimed as PBI**. This ERRP outlines the actions that Trillium Piketon, LLC (Trillium) 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.

If TCSC obtains evidence that the injected carbon dioxide (CO₂) stream and associated pressure front may cause an endangerment to a USDW, the environment, or the public, TCSC will:

- Immediately cease injection.
 - In some circumstances, TCSC will, in consultation with the UIC Program Director, determine whether gradual injection cessation is more appropriate.
- Take all steps necessary to identify and characterize any CO₂ release.
- Notify the UIC Program Director within 24 hours.
- Implement applicable portions of the approved ERRP.

TCSC will update this ERRP every five years. When necessary, TCSC will submit an amended ERRP or demonstrate to the Director that no amendment to the ERRP is needed.

10.1. LOCAL RESOURCES AND INFRASTRUCTURE

The TCSC Area of Review (AoR) covers an approximately **Claimed as PBI**, Ohio. Infrastructure and natural resources in the vicinity of TCSC that may be affected as a result of an emergency event at the project site include (**Figure 10-1**):

- Urban areas
- Protected areas
- CO₂ project infrastructure
- **Claimed as PBI**
- Water wells
- Oil and gas wells
- Mines



Figure 10-1. Project elements, infrastructure and natural resources within the TCSC AoR.

10.2. POTENTIAL RISK SCENARIOS

Events that would trigger emergency responses include incidents that lead to contamination of a USDW, could cause personal injury, or result in property damage. These events may occur during the construction, injection, or PISC periods.

The following events could potentially result in an emergency response at TCSC:

- Injection or monitoring well integrity failure.
- Injection well monitoring equipment failure.
- Brine or CO₂ leakage to a USDW.
- A natural disaster.
- An induced or natural seismic event.

Response actions will depend on the severity of the event(s) triggering an emergency response. The degrees of risk for emergency events are defined in **Table 10-1** and match EPA guidance.

Table 10-1. Degrees of Risk for Emergency Events.

Degree of Risk	Definition
Major Emergency	The event poses an 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 a potentially serious (or significant) near-term risk to human health, resources, or infrastructure if conditions worsen, or no response actions are taken.
Minor Emergency	The event poses no immediate risk to human health, resources, or infrastructure.

10.3. EMERGENCY IDENTIFICATION AND RESPONSE ACTIONS

Steps to identify and characterize the event will depend on the specific issue identified and the severity of the event. The potential risk scenarios are detailed below.

10.3.1. Well Integrity Failure

Loss of well integrity may endanger USDWs. Loss of well integrity loss may have occurred if:

- 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.
- Mechanical integrity tests show a loss of mechanical integrity.

Response actions:

- Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).
- Determine the event's severity, based on available information, within 24 hours of notification.
- For a Major or Serious emergency:
 - Initiate shutdown plan.
 - Shut in the well by closing the flow control valve, then close the isolation valve.
 - Limit wellhead access to authorized safety personnel only.
 - Communicate with TCSC personnel and local authorities to initiate evacuation procedures.
 - Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).
 - If contamination is detected, identify and implement appropriate well and environmental remedial actions to counteract contamination (in consultation with the UIC Program Director).
 - If contamination is detected, identify and implement appropriate remedial actions (in consultation with the UIC Program Director).
- For a Minor emergency:
 - Conduct an assessment to determine whether mechanical integrity has been lost.
 - If there has been a loss of mechanical integrity, initiate the shutdown plan.
 - Shut in the well, closing the flow control valve, then close the isolation valve.
 - Determine the cause and remediate the issue.

- Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause and extent of failure.
- Identify and, if necessary, implement appropriate well and environmental remedial actions (in consultation with the UIC Program Director).
- Remediate issues.
- Restart injection.

10.3.2. 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.

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.
 - Shut in the well by closing the flow control valve, then close the isolation valve.
 - Limit access to the wellhead to authorized safety personnel only.
 - Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).
 - Fix malfunctioning equipment.
 - Identify and, if necessary, implement appropriate environmental remedial actions (in consultation with the UIC Program Director).
 - Identify and, if necessary, implement appropriate remedial actions (in consultation with the UIC Program Director).
- For a Minor emergency:
 - Conduct an assessment to determine whether mechanical integrity has been lost.
 - If there has been a loss of mechanical integrity, initiate the shutdown plan.
 - Shut in the well, close the flow control valve, and then close the isolation valve.
 - Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause and extent of failure.
 - Identify and, if necessary, implement appropriate remedial actions (in consultation with the UIC Program Director).
 - Fix malfunctioning equipment.
 - Identify and, if necessary, implement appropriate environmental remedial actions (in consultation with the UIC Program Director).
 - Remediate issues.
 - Restart injections.

10.3.3. Potential Brine or CO₂ leakage to a USDW or the Surface

Elevated concentrations of indicator parameter(s) in groundwater sample(s) or other evidence of fluid (brine) or CO₂ leakage into a USDW.

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 all emergencies (Major, Serious, or Minor):
 - Initiate shutdown plan.
 - Shut in the well by closing the flow control valve, then close the isolation valve.
 - Collect (a) groundwater confirmation sample(s) and analyze for indicator parameters.
 - 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 is being utilized and has been caused to exceed drinking water standards.
 - Proceed with efforts to remediate USDW to mitigate unsafe conditions (e.g., install a system to intercept/extract brine or CO₂ or “pump and treat” to aerate CO₂-laden water). [REDACTED]
 - [REDACTED]
 - [REDACTED]
 - [REDACTED]
 - [REDACTED]
 - [REDACTED]
 - Continue frequent groundwater remediation and monitoring (the frequency to be determined by Trillium Piketon and the UIC Program Director) until the adverse USDW impact has been fully addressed.

10.3.4. Natural Disaster

Well problems may arise due to a natural disaster affecting the regular operation of the injection well. An earthquake may disturb surface and/or subsurface facilities, and weather-related disasters may affect surface facilities.

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.
 - Shut in the well by closing the flow control valve, then close the isolation valve.
 - Isolate supply pipeline, if required.

- Vent CO₂ from surface facilities, if required.
- Limit access to the wellhead to authorized personnel only.
- Communicate with TCSC personnel and local authorities to initiate the evacuation plans as necessary.
- Monitor well pressure, temperature, and annulus pressure to verify well status and determine the cause and extent of any damage.
- Determine if any leaks to groundwater or surface water occurred.
- If contamination or endangerment is detected, identify and implement appropriate environmental remedial actions (in consultation with the UIC Program Director).
- For a Minor emergency:
 - Conduct an assessment to determine whether mechanical integrity has been lost.
 - If there has been a loss of mechanical integrity, initiate the shutdown plan.
 - Shut in the well by closing the flow control valve, then close the isolation valve.
 - Vent CO₂ from surface facilities if required.
 - Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause and extent of failure
 - Identify and, if necessary, implement appropriate remedial actions (in consultation with the UIC Program Director).
 - Identify and, if necessary, implement appropriate environmental remedial actions (in consultation with the UIC Program Director).
 - Remediate issues.
 - Restart injection.

10.3.5. Induced or Natural Seismic Event

Southern Ohio has low (5-25%) chance of slight damaging natural earthquake shaking (see **Narrative**). 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 (**Table 10-2**). 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 current state of the site is GREEN.

Table 10-2: Seismic monitoring system for seismic events with a magnitude above 1.0 and an epicenter within the AoR.

Operating State	Threshold Condition ¹²	Response Action ³
Green	$M \leq 1.5$	Continue normal operation with permitted levels
Yellow	> 5 seismic events within 30 days having $1.5 < M \leq 2.0$	<ol style="list-style-type: none"> 1. Continue normal operation within permitted levels. 2. Within 24 hours of the incident, notify the UIC Program Director of the operating status of the facility.
Orange	$M > 1.5$ with or felt report or $M > 2.0$ without felt report	<ol style="list-style-type: none"> 1. Continue normal operation within permitted levels. 2. Within 24 hours of the incident, notify the UIC Program Director of the operating status of the facility. 3. Review seismic and operational data. 4. Report findings to the UIC Program Director and issue corrective actions.
Magenta	$M > 2.0$ with a felt report	<ol style="list-style-type: none"> 1. Initiate a rate reduction plan. 2. Notify the UIC Program Director of the facility's operating status within 24 hours of the incident. 3. Communicate with facility personnel and local authorities to initiate evacuation plans as necessary. 4. Monitor well pressure and temperature to verify well status and determine the cause and extent of any failure. 5. Identify and implement appropriate remedial actions (in consultation with the UIC Program Director). 6. Determine if leaks to groundwater or surface water occurred, 7. If USDW contamination is detected: <ol style="list-style-type: none"> a. Notify the UIC Program Director within 24 hours of the determination. b. Initiate the shutdown plan. c. Shut in the well. d. Vent CO₂ from surface facilities. e. Collect groundwater confirmation samples and analyze for indicator parameters. f. If the presence of indicator parameters is confirmed, develop (in consultation with the UIC Program Director) a case-specific workplan to: <ol style="list-style-type: none"> i. Install additional groundwater monitoring points [REDACTED] near the affected groundwater well(s) to delineate the extent of impact. ii. Remediate unacceptable impacts of the affected USDW. g. If USDWs exceed drinking water standards, arrange an alternate potable water supply.

¹ Specified magnitudes refer to magnitudes determined by the Ohio Department of Natural Resources OhioSeis network 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 of change in operating state.

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Emergency and Remedial Response Plan

Operating State	Threshold Condition ¹²	Response Action ³
		<ul style="list-style-type: none"> h. Proceed with efforts to remediate the USDW (e.g., install a system to extract brine or CO₂ or “pump and treat” to aerate CO₂-laden water). 8. Review seismic and operational data. 9. Report findings to the UIC Program Director and issue corrective actions.
Red	M > 2.0 and confirmation of damage	<ul style="list-style-type: none"> 1. Initiate the shutdown plan. 2. Within 24 hours of the incident, notify the UIC Program Director of the facility's operating status. 3. Communicate with facility personnel and local authorities to initiate evacuation plans as necessary. 4. Monitor well pressure and temperature to verify well status and determine the cause and extent of any failure. 5. Identify and implement appropriate remedial actions (in consultation with the UIC Program Director). 6. Determine if leaks to groundwater or surface water occurred. 7. If USDW contamination is detected: <ul style="list-style-type: none"> a. Notify the UIC Program Director within 24 hours of the determination. b. Initiate shutdown plan. c. Shut in the well. d. Vent CO₂ from surface facilities. e. Collect groundwater confirmation samples and analyze for indicator parameters. f. If the presence of indicator parameters is confirmed, develop (in consultation with the UIC Program Director) a case-specific work plan to: <ul style="list-style-type: none"> i. Install additional groundwater monitoring points Claimed as PBI near the affected groundwater well(s) to delineate the extent of impact. ii. Remediate unacceptable impacts to the affected USDW. g. If USDWs exceed drinking water standards, arrange an alternate potable water supply. h. Proceed with efforts to remediate USDW to mitigate unsafe conditions (e.g., install a system to extract brine or CO₂ or “pump and treat” to aerate CO₂-laden water, Claimed as PBI). 8. Review seismic and operational data. 9. Report findings to the UIC Program Director and issue corrective actions.

10.4. RESPONSE PERSONNEL AND EQUIPMENT

Site personnel, project personnel, and local authorities will be critical to successfully implementing this ERRP. Piketon is the closest population center to TCSC (**Figure 10-1**). **Table 10-3** lists the contact information of critical local, state, and federal authorities that will be contacted during an emergency at TCSC. This list will be reviewed annually and updated to reflect the most current contact information .

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.

Response actions will generally not require specialized equipment to implement. Trillium will be responsible for procuring any necessary additional specialized equipment (e.g., drilling rigs or logging equipment).

Table 10-3. Emergency Contact Phone Numbers.

Facility Contacts	Phone Number
24-hour Emergency Contact During Construction: Project Manager - Caitlin Holley	(614) 357-2566
24-hour Emergency Contact During Operation and Post-Injection: Project Manager - Caitlin Holley	(614) 357-2566
Local Agencies	
Pike County Emergency Management Agency (includes Pike County Sheriff's Office)	(740) 947-7346
Southern Ohio Medical Center, Portsmouth	(740) 356-5000
Adena Pike Medical Center, Waverly	(740) 947-2186
Piketon Seal Township Fire Department	(740) 289-2531
Scioto County Sheriff's Office	(740) 355-8261
Ohio LEPC Emergency Coordinator – for reportable spills/releases	(740) 947-2111
State Agencies	
Ohio Emergency Management Agency	(614) 889-7150
Ohio EPA 24-hour emergency spill hotline	1-800-282-9378
Federal Agencies	
U.S. EPA Region 5 UIC Program Director – Andrew Greenhagan	(312) 353-7648
National Response Center (NRC)	1-800-424-8802

10.5. 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 **Table 10-3** as soon as possible after requesting outside assistance from local emergency responders.

Trillium will communicate to the public about any event that requires an emergency response to ensure the public understands what happened and whether there are any environmental, health, or safety implications. 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.

Trillium will work closely with the local broadcasting and news agencies in Piketon to communicate necessary details about the emergency to the public. Trillium will provide periodic updates to the broadcasting and news agencies to be communicated to the public.

In the case of an emergency that requires an evacuation, Trillium will communicate and work with the local offices of Emergency Management in Pike County to evacuate the public from the areas directly affected by project operations. Trillium will work with local officials to identify options to support displaced locals with lodging for those directly affected by the emergency caused by the project until the evacuation order is lifted or experts have deemed it safe to return home. In addition, Trillium will work closely with the mayors and judges in the affected areas to issue a mandatory evacuation order for the public, if necessary.

Trillium 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), Trillium will provide periodic updates on the progress of the response action(s).

Trillium will work with the Regional Response Teams and local environmental agencies to map the impacted zone and identify the areas with the highest risk potential. Also, Trillium will map the nearby environmentally sensitive areas, well locations, facility location, and entrances and exits to be communicated to the response team.

Trillium 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), CO₂ source(s), management organization(s), pipeline operator(s), landowners, Regional Response Teams (as part of the National Response Team), and local authorities.

10.6. PLAN REVIEW

This ERRP shall be periodically reviewed as follows:

- At least once every five years following EPA's approval to inject,
- After an AoR reevaluation,
- Following any significant changes to the injection process or the injection facility, or an emergency event, and

An amended ERRP will be submitted to the UIC Program Director within one 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, incorporated into the permit, and subject to permit modification requirements. If the review indicates that no amendments to the ERRP are necessary, Trillium will provide the UIC Program Director with the documentation supporting the "no amendment necessary" determination. Annual updates to the Emergency Contact List and clarifying or making corrections are not considered amendments to the ERRP and do not require permit modification.

10.7. STAFF TRAINING AND EXERCISE PROCEDURES

Trillium will integrate the ERRP into its existing operating procedures and training protocols. Trillium will determine the required training programs for each employee commensurate with their job function, safety requirements, and regulatory requirements. All hub employees will be trained, which will be documented before commencing injection. Trillium will hold safety meetings with each contractor before any new contract work, explaining emergency measures specific to the contractor's work. Trillium will provide information about employee training status, schedules, and coursework to appropriate authorities upon request and before commencing injection.

All Trillium field personnel will be trained and equipped with the necessary skills to ensure a safe working environment and respond correctly in an emergency. Trillium 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

Trillium will review these recommended practices to design and implement training programs that are generally adequate for field personnel 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 personnel can respond adequately and quickly in an emergency.

Trillium 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
- Occupational Safety and Health Administration (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 the ERRP.