Class VI Injection Well Application

Attachment 09: Emergency and Remedial Response Plan
40 CFR 146.94(a)

Aster Project
Madison County, Indiana

24 July 2024

Project Information

Project Name: Aster

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Aster Project Injection Well 1 (AST INJ1) Location:
Madison County, Indiana
Latitude: 40.30026° N
Longitude: -85.65565° W

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List of Acronyms

AoR	Area of Review
AST INJ1	Aster Project Injection Well 1
AST OBS1	Aster Project Deep Observation Well 1
CO_2	carbon dioxide
ERR	Emergency and Remedial Response
ERRP	Emergency and Remedial Response Plan
ISM	induced seismicity monitoring
MAIP	maximum allowable injection pressure
MIT	Mechanical Integrity Test
PISC	post-injection site care and site closure
SOP	Standard Operating Procedure
TBD	to be determined
UIC	Underground Injection Control
USDW	underground source of drinking water

1. Introduction

This section of the permit application addresses the Emergency and Remedial Response Plan (ERRP) that Vault GSL CCS Holdings LP will implement for the Aster Project. The ERRP describes the actions that Vault GSL CCS Holdings LP shall take to address and remediate mechanical integrity issues, induced seismic events, and other events that could allow for the movement of the injected fluid or formation brine in a manner that may endanger an underground source of drinking water (USDW) during the construction, operation, or post-injection site care periods.

In accordance with 40 CFR 146.94 (b), should Vault GSL CCS Holdings LP obtain evidence that the injected the carbon dioxide (CO_2) stream and/or associated pressure front may cause an endangerment to a USDW, Vault GSL CCS Holdings LP will perform the following actions:

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

Where the phrase "initiate shutdown plan" is used, the following protocol will be employed:

- Vault GSL CCS Holdings LP will immediately cease injection.
- However, in some circumstances, Vault GSL CCS Holdings LP will, in consultation with the UIC Program Director, determine whether gradual cessation of injection is appropriate (using the parameters set forth in the Summary of Requirements of the Class VI permit).

2. Local Resources and Infrastructure

Resources in the Area of Review (AoR) of the project that may be affected as a result of an emergency event at the project site include the shallow and lowermost USDWs as discussed in Attachment 01: Narrative, (2024). These include:

- Unconsolidated Quaternary aquifers, and
- Pleasant Mills Formation, the lowermost USDW.

In addition to these local aquifers, several surface bodies of water are also located within the AoR (Figure 1). These include:

- Star Creek,
- Pisgah Run,
- and small, unnamed tributaries.

No population centers or towns are located within the AoR that could be affected by an emergency at the project site. Alexandria, IN is the closest population center to the AoR and is sited approximately 1.7 miles southwest from the proposed injection well.

No major water sources or treatment facilities are within the AoR. Notable or historic public infrastructure (parks, cemeteries, historic farms or buildings etc.) within the AoR include (Figure 1):

- an unnamed historic contributing farm (Indiana DNR, Historic Preservation & Archaeology, 2021),
- Mt. Pisgah Cemetery, and
- Vinson Cemetery.

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

Claimed as PBI

3. Potential Risk Scenarios

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

- Aster Project Injection Well 1 (AST INJ1) or Aster Project Deep Observation Well 1 (AST OBS1) well integrity failure,
- Injection well monitoring equipment failure,
- Fluid (non-CO_2) or CO_2 leakage into a USDW,
- Natural Disaster, or
- Induced 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 1.

Construction materials confirmed to be suitable for long-term corrosive loading will be used for this project.

Table 1: Degrees of risk for emergency events.

Emergency Condition	Definition
Major emergency (high risk)	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 (medium risk)	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 (low risk)	Event poses no immediate risk to human health, resources, or infrastructure.

4. Emergency Identification and Response Actions

The steps required to identify and characterize an event related to potential risk scenarios will be dependent on the specific issue identified and the severity of the event; these are discussed in more detail in this section.

Once equipment placement and location are finalized, figures will be provided that show the following:

- Project wells,
- Monitoring equipment,
- Emergency shut-down equipment, and
- Flowlines.

It is important to note that in major or serious events, certain actions may be taken to minimize the impact of such events before they are listed in the following action plans. Additionally, as part of the minimization of these events, emergency services may be contacted prior to any other actions taking place.

4.1. Well Integrity Failure (AST INJ1 or AST OBS1)

Integrity loss of the injection well and/or observation well may endanger USDWs. Integrity loss may have occurred if the following events occur. Note that this is not an exhaustive list:

- Automatic shutdown devices are activated:
    - *Wellhead pressure* exceeds the maximum allowable injection pressure (MAIP).
        - The shutdown pressure limit will be set to 1,420 psi, approximately 1% less than the proposed MAIP.
    - *Annulus pressure* indicates a loss of external or internal well containment
        - The emergency shutdown points of -5 or 1,500 psi are exceeded (Attachment 01: Narrative, 2024).
    - Note: pursuant to 40 CFR 146.94(b)(3), Vault GSL CCS Holdings LP will notify the UIC Program Director within 24 hours of any triggering of an emergency shutdown system.
- Mechanical Integrity Test (MIT) identifies a loss of mechanical integrity.
    - Note: pursuant to 40 CFR 146.94(b)(3), Vault GSL CCS Holdings LP will notify the UIC Program Director within 24 hours of a loss of mechanical integrity that could lead to endangerment of the USDW.

4.1.1. Well Integrity Failure – Event Classifications

Potential well integrity failure event classifications are listed in Table 2.

Table 2: Well integrity failure – event classifications.

	Minor	Serious	Major
Conditions	1. General failure of any of the components of the internal mechanical system (wellhead, packer, tubing, or casing). 2. No immediate or potential serious (or significant) near term risk to human health, resources, or infrastructure is present should remedial actions not be taken	1. General failure of any of the components of the internal mechanical system (wellhead, packer, tubing, or casing); or, 2. General failure of any of the components of the external mechanical system. 3. Potential serious (or significant) near term risk to human health, resources, or infrastructure is present	1. General failure of any of the components of the internal mechanical system (wellhead, packer, tubing, or casing); or, 2. General failure of any of the components of the external mechanical system. 3. Immediate serious (or significant) near term risk to human health, resources, or infrastructure is present necessitating evacuation of impacted locations.
Severity	**Low**	**Medium**	**High**
Timing of Event	Injection and post-injection site care and site closure (PISC) phase	Injection and PISC phase	Injection and PISC phase
Avoidance Measures	Following all manufacturer handling and operational specifications and guidelines for well components	Following all manufacturer handling and operational specifications and guidelines for well components	Following all manufacturer handling and operational specifications and guidelines for well components
Detection Methods	Continuous monitoring of the well components such as pressure monitoring, annular volume monitoring, corrosion monitoring	Continuous monitoring of the well components such as pressure monitoring, annular volume monitoring, corrosion monitoring	Continuous monitoring of the well components such as pressure monitoring, annular volume monitoring, corrosion monitoring

4.1.2. Well Integrity Failure – Response Actions

Potential response actions for all identified event classifications are listed in Table 3.

Table 3: Potential response actions – identified event classifications:

Response Action	Emergency Level	Steps	
Notify local or regional government emergency services if appropriate.			
Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.94(b)(3).			
Determine the severity of the event, based on the information available, within 24 hours of notification.	Serious/ Major	Initiate shutdown plan	1. Shut-in the well a. All necessary valves closed and locked out.
			2. Vent CO_2 from surface lines and facility as necessary.
			3. Limit access to wellhead and surface facilities to only those authorized. a. Caution tape and/or rope may be used to limit access to the well and facility
			4. Initiate evacuation plans (if necessary) a. Communicate at all times with personnel and local authorities if evacuation is necessary
			5. Monitor wellhead pressure (tubing and annulus) and temperature as is feasible a. This information should be used to assess the nature and extent of the mechanical integrity failure.
			6. Identify appropriate remedial actions to repair damage to the failed component(s) of the well.
		If contamination is detected, identify, and implement appropriate remedial actions.	1. Potential actions are listed in the Emergency and Remedial Response (ERR) portion of the Financial Assurance section of this application and are dependent on the magnitude of any potential contamination (Attachment 03: Financial Assurance Plan, 2024).
		Perform MIT prior to bringing the well back online	
	Minor	Assess the well to determine whether there has been a loss of mechanical integrity.	
		If a loss of mechanical integrity is present, initiate the shutdown plan	1. Shut-in the well a. All necessary valves closed and locked out.
			2. Vent CO_2 from surface lines and facility as necessary.
			3. Limit access to wellhead and surface facilities to only those authorized. a. Caution tape and/or rope may be used to limit access to the well and facility
			4. Reset automatic shutdown devices
			5. Monitor wellhead pressure (tubing and annulus) and temperature as is feasible a. This information should be used to assess the nature and extent of the mechanical integrity failure.
			6. Identify appropriate remedial actions to repair damage to the failed component(s) of the well if necessary
		If contamination is detected, identify, and implement appropriate remedial actions.	1. Potential actions are listed in the ERR portion Financial Assurance section of this application and are dependent on the magnitude of any potential contamination (Attachment 03: Financial Assurance Plan, 2024).
		Perform MIT prior to bringing the well back online.	

Response personnel may include, but are not limited to:

- On-call and/or present staff or other operational staff at the facility,
- Operations and/or facility manager,
- Contracted staff/personnel, and
- Local or regional government emergency services.

Equipment used to detect or remedy the failure may include, but are not limited to:

- Pressure/temperature sensors,
- Logging equipment,
- Workover rig,
- New cement, casing, tubing, packer, or wellhead components.

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. This subsection covers the remedial response and procedures to be followed should one (or more) of the following monitoring sensors fail:

- Wellhead injection pressure
- Wellhead injection temperature
- Annulus pressure
- Annulus fluid volume
- Injection flowrate

4.2.1. Well Monitoring Equipment Failure – Classifications

Well monitoring equipment failure classifications are listed in Table 4.

Table 4: Well monitoring equipment failure – event classifications.

	Minor	Serious	Major
Conditions	1. General failure of any of the components of the monitoring system. 2. No immediate or potential serious (or significant) near term risk to human health, resources, or infrastructure is present should remedial actions not be taken.	1. General failure of any of the components of the monitoring system. 2. Potential serious (or significant) near term risk to human health, resources, or infrastructure is present.	1. General failure of any of the components of the monitoring system. 2. General failure of any of the components of the external mechanical system. 3. Immediate serious (or significant) near term risk to human health, resources, or infrastructure is present necessitating evacuation of impacted locations.
Severity	**Low**	**Medium**	**High**
Timing of event	Injection and PISC phase.	Injection and PISC phase.	Injection and PISC phase.
Avoidance measures	Following all manufacturer handling and operational specifications and guidelines for well monitoring components.	Following all manufacturer handling and operational specifications and guidelines for well monitoring components.	Following all manufacturer handling and operational specifications and guidelines for well monitoring components.
Detection methods	Continuous monitoring of the components of the monitoring equipment as well as routine equipment maintenance and calibration.	Continuous monitoring of the components of the monitoring equipment as well as routine equipment maintenance and calibration.	Continuous monitoring of the components of the monitoring equipment as well as routine equipment maintenance and calibration.

4.2.2. Well Monitoring Equipment Failure – Response Actions

Response actions for all identified potential event classifications are listed in Table 5.

Table 5: Response actions – all identified potential event classifications.

Response Action	Emergency Level	Steps	
Notify local or regional government emergency services if appropriate.			
Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.94(b)(3).			
Determine the severity of the event, based on the information available, within 24 hours of notification.	Serious/ Major	Initiate shutdown plan	1. Shut-in the well a. All necessary valves closed and locked out.
			2. Vent CO_2 from surface lines and facility as necessary.
			3. Limit access to wellhead and surface facilities to only those authorized. a. Caution tape and/or rope may be used to limit access to the well and facility.
			4. Initiate evacuation plans (if necessary) a. Communicate at all times with personnel and local authorities if evacuation is necessary.
			5. Monitor wellhead pressure (tubing and annulus) and temperature as is feasible a. This information should be used to assess the nature and extent of the mechanical integrity failure.
			6. Identify appropriate remedial actions to repair damage to the failed component(s) of the well.
		If contamination is detected, identify, and implement appropriate remedial actions.	1. Potential actions are listed in the ERR portion Financial Assurance section of this application and are dependent on the magnitude of any potential contamination (Attachment 03: Financial Assurance Plan, 2024).
		Perform MIT prior to bringing the well back online	
	Minor	Assess the well to determine whether there has been a loss of mechanical integrity. If no loss is present, assess the impact the loss of monitoring equipment could have on operations.	1. If the impact is negligible, implement the viable alternative method of monitoring determined during the initial assessment.
			2. Plans to replace the equipment should consider replacing the equipment as soon as is feasible based on operational conditions and suitability of the alternative method of monitoring.
			3. Provide details of the equipment failure, the alternative method of monitoring, and impact to continuous data collection to the UIC Program Director as part of the routine operational reporting.

Response Action	Emergency Level	Steps	
		If a loss of mechanical integrity is present, initiate the shutdown plan.	1. Shut-in the well. a. All necessary valves closed and locked out.
			2. Vent CO_2 from surface lines and facility as necessary.
			3. Limit access to wellhead and surface facilities to only those authorized. a. Caution tape and/or rope may be used to limit access to the well and facility.
			4. Reset automatic shutdown devices.
			5. Monitor wellhead pressure (tubing and annulus) and temperature as is feasible. a. This information should be used to assess the nature and extent of the mechanical integrity failure.
		If contamination is detected, identify, and implement appropriate remedial actions.	6. Identify appropriate remedial actions to repair damage to the failed component(s) of the well if necessary.
		Perform MIT prior to bringing the well back online.	

Response personnel may include, but are not limited to:

- On-call and/or present staff or other operational staff at the facility,
- Operations and/or facility manager,
- Contracted staff/personnel, and,
- Local or regional government emergency services.

Equipment used to detect or remedy the failure may include, but are not limited to:

- Pressure/temperature sensors
- Logging equipment
- Workover rig
- New cement, casing, tubing, packer, or wellhead components

4.3. Natural Disaster

Disturbance or damage as a result of a natural disaster may impact the normal operation of the project. A non-exhaustive list of examples of such potential events and the impact to the project they may cause are:

- An earthquake disturbs surface and/ or subsurface facilities,
- Lightning strikes the wellhead and damages surface monitoring equipment,
- Severe flooding (i.e., 100-year flood) limits access or damages the well or injection facility.

4.3.1. Natural Disaster – Event Classifications

Natural disaster event classifications are described in Table 6.

Table 6: Natural disaster – event classifications.

	Minor	Serious	Major
Conditions	1. General failure of any of the components of the monitoring system or well integrity due to natural disaster (AST INJ1 or AST OBS1).	1. General failure of any of the components of the monitoring system or well integrity due to natural disaster (AST INJ1 or AST OBS1).	1. General failure of any of the components of the monitoring system or well integrity due to natural disaster (AST INJ1 or AST OBS1).
	2. Inability to access wellsite due to natural event (disaster).	2. Inability to access wellsite due to natural event (disaster).	2. Inability to access wellsite due to natural event (disaster).
	3. No immediate or potential serious (or significant) near term risk to human health, resources, or infrastructure is present should remedial actions not be taken.	3. Potential serious (or significant) near term risk to human health, resources, or infrastructure is present.	3. Immediate serious (or significant) near term risk to human health, resources, or infrastructure is present necessitating evacuation of impacted locations.
Severity	**Low**	**Medium**	**High**
Timing of event	Any time in project life.	Any time in project life.	Any time in project life.
Avoidance measures	Installing equipment to lessen the impact of these naturally occurring events (i.e., a lightning rod in an elevated position, or wellsite and wellsite access being above the local elevation).	Installing lightning rods in an elevated position, siting the wellsite and wellsite access above local ground level, and following appropriate building codes	Installing lightning rods in an elevated position, siting the wellsite and wellsite access above local ground level, and following appropriate building codes
Detection methods	Observance of local forecasts. Lightning strikes or minor flooding events temporarily prevent access to the well or other sequestration facilities.	Observance of local forecasts. Intense lightning strikes or major flooding prevent access to the well or other sequestration facilities and/or causes damage to project related infrastructure.	Observance of local forecasts. Lightning strikes causing immediate wellhead failure, flooding leading to immediate wellhead failure, a tornado causing nearby damage to project related equipment or facility equipment, or wildfire causing immediate damage to project related equipment

4.3.2. Natural Disaster – Response Actions

These events may impact or damage the ability to properly operate the well or use the facility for the intended purposes of the project. If a natural disaster occurs that affects normal operation of the injection well, the response actions will be followed as outlined in Table 7:

Table 7: Natural disaster – response actions.

Response Action	Emergency Level	Steps	
Notify local or regional government emergency services if appropriate			
Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.94(b)(3)			
Determine the severity of the event, based on the information available, within 24 hours of notification.	Serious/ Major	Initiate shutdown plan (as safely possible).	1. Shut-in the well. a. All necessary valves closed and locked out.
			2. Vent CO_2 from surface lines and facility as necessary.
			3. Limit access to wellhead and surface facilities to only those authorized. a. Caution tape and/or rope may be used to limit access to the well and facility.
			4. Initiate evacuation plans (if necessary). a. Communicate at all times with personnel and local authorities if evacuation is necessary.
			5. Monitor wellhead pressure (tubing and annulus) and temperature as is feasible. a. This information should be used to assess the nature and extent of the mechanical integrity failure.
			6. Identify appropriate remedial actions to repair damage to the failed component(s) of the well.
		If contamination is detected, identify, and implement appropriate remedial actions.	1. Potential actions are listed in the ERR portion Financial Assurance section of this application and are dependent on the magnitude of any potential contamination (Attachment 03: Financial Assurance Plan, 2024).
		Perform MIT prior to bringing the well back online.	
	Minor	Assess the well to determine whether there has been a loss of mechanical integrity.	
		If a loss of mechanical integrity is present, initiate the shutdown plan.	1. Shut-in the well. a. All necessary valves closed and locked out.
			2. Vent CO_2 from surface lines and facility as necessary.
			3. Limit access to wellhead and surface facilities to only those authorized. a. Caution tape and/or rope may be used to limit access to the well and facility.
			4. Reset automatic shutdown devices.
			5. Monitor wellhead pressure (tubing and annulus) and temperature as is feasible. a. This information should be used to assess the nature and extent of the mechanical integrity failure.
			6. Identify appropriate remedial actions to repair damage to the failed component(s) of the well if necessary.
		If contamination is detected, identify, and implement appropriate remedial actions.	1. Potential actions are listed in the ERR portion Financial Assurance section of this application and are dependent on the magnitude of any potential contamination (Attachment 03: Financial Assurance Plan, 2024).
		Perform MIT prior to bringing the well back online.	

4.4. Non-CO_2 (Brine) Fluid or CO_2 Leakage into USDW or Surface

Table 8 describes the event classifications of elevated concentrations of indicator parameter(s) in shallow groundwater sample(s) or other evidence of fluid (brine) or CO_2 leakage into a USDW.

4.4.1. Brine or CO_2 Leakage into USDW or Surface – Event Classifications

Table 8: Brine or CO_2 leakage into USDW or surface - event classifications.

	Minor	**Serious**	**Major**
Conditions	1. Small surface release of CO_2 with no immediate or potential serious (or significant) near term risk to human health, resources, or infrastructure is present should remedial actions not be taken.	1. Leakage into a lowermost USDW, or a shallow aquifer that results in detectable changes of water composition or quality. 2. Potential serious (or significant) near term risk to human health, resources, or infrastructure is present as a result of brine or CO_2 leakage.	1. Leakage into a USDW that is used for private or agricultural purposes. 2. Surface release of CO_2 within the project area. 3. Potential serious (or significant) near term risk to human health, resources, or infrastructure is present as a result of brine or CO_2 leakage.
Severity	Low	Medium	High
Timing of Event	Injection Phase and with decreasing likelihood in the PISC phase.	Injection Phase and with decreasing likelihood in the PISC phase.	Injection Phase and with decreasing likelihood in the PISC phase.
Avoidance Measures	Routine mechanical integrity testing, regular inspection and servicing of all valves and surface equipment.	Thorough site characterization during the pre-operational testing and well construction phase, routine mechanical integrity testing, the evaluation of monitoring data collected during the operational phase, adherence to approved operational limits, and periodic surface seismic surveys.	Thorough site characterization during the pre-operational testing and well construction phase, routine mechanical integrity testing, the evaluation of monitoring data collected during the operational phase, adherence to approved operational limits, and periodic surface seismic surveys.
Detection Methods	Surface gas/CO_2 monitors.	Continuous monitoring of the well components such as pressure monitoring, corrosion monitoring, routine mechanical integrity testing and PNL activities, routine groundwater sampling.	Continuous monitoring of the well components such as pressure monitoring, corrosion monitoring, routine mechanical integrity testing and PNL activities, routine groundwater sampling.

4.4.2. Brine or CO_2 Leakage into USDW or Surface – Response Actions

Table 9 describes the response actions for potential brine or CO_2 leakage into a USDW or surface water.

Table 9: Brine or CO_2 leakage into USDW or surface water – response actions:

Response Action	Emergency Level	Steps	
Notify local or regional government emergency services if appropriate.			
Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.94(b)(3).			
Determine the severity of the event, based on the information available, within 24 hours of notification.	Serious/ Major	Initiate shutdown plan.	1.Shut-in the well. a. All necessary valves closed and locked out.
			2. Vent CO_2 from surface lines and facility as necessary.
			3. Limit access to wellhead and surface facilities to only those authorized. a. Caution tape and/or rope may be used to limit access to the well and facility.
			4. Initiate evacuation plans (if necessary). a. Communicate at all times with personnel and local authorities if evacuation is necessary.
		Determine contamination location and severity.	1. Collect confirmation sample(s) of groundwater and perform groundwater constituent analysis to determine elevated parameters.
		The following plan(s) of action may be initiated should drinking water be negatively impacted.	1. Potential actions are listed in the ERR portion Financial Assurance section of this application and are dependent on the magnitude of any potential contamination (Attachment 03: Financial Assurance Plan, 2024). Such actions may include: a. Drill new water monitoring wells, to facilitate data collection to evaluate the spatial extent, existence, and/or significance of a potential release-related plume. b. Quarterly sampling and analysis for standard field measurements and heavy metals. c. Residential replacement water until permanent treatment can be installed. d. Purchase and installation of residential reverse osmosis (RO) units.
	Minor	Initiate shutdown plan.	1. Shut-in the well. a. All necessary valves closed and locked out.
			2. Vent CO_2 from surface lines and facility as necessary.
			3. Limit access to wellhead and surface facilities to only those authorized. a. Caution tape and/or rope may be used to limit access to the well and facility.
			4 Initiate evacuation plans (if necessary). a. Communicate at all times with personnel and local authorities if evacuation is necessary.
		Remediate source of leak.	1. Determine source of surface release by appropriate means.
			2. Repair source of leak as possible.
			3. Test repair to appropriate maximum operational conditions.
			4. Return well to service.

4.5. Induced Seismic Event

Induced seismic events typically refer to minor seismic events that are caused by human activity. These events can be caused when injection activity alters the stresses or fluid pressures in subsurface formations. The change in stress can cause fault movement and energy release. This energy release results in induced seismic events.

Natural seismicity is not expected to affect the project, as the project site approximately 45 miles west of the Moderate Shaking Zone associated with the Anna Seismic Zone in western Ohio. Vault GSL CCS Holdings LP plans to inject CO_2 into the Mt. Simon Sandstone and will monitor for natural and induced seismicity in the area. A surface-based induced seismicity monitoring (ISM) array will be used to accurately determine the locations and magnitudes of potential injection-induced seismic events with the primary goals of:

- Addressing public and stakeholder concerns related to induced seismicity,
- Qualitatively monitoring the spatial extent of the pressure front from the distribution of seismic events,
- Identification of activity that may indicate failure of the confining zone and possible containment loss.

Based on the continuous analysis of the observed level of seismic activity, and any 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 site personnel with information about the potential risk of further seismic activity and guides them through a series of response actions.

The ISM system operating state structure is presented in Table 10. The table corresponds each level of operating state with the threshold conditions and operational response actions.

Table 10: Seismic monitoring system for seismic events within the project AoR

Operating State	Threshold Condition [1,2]	Response Action [3]
Green	Seismic events less than or equal to M1.5	1. Continue normal operation within permitted levels.
Yellow	Five 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. Within 24 hours of the event, notify the UIC Program Director of the operating status of the well.
Orange	Seismic event greater than M1.5 and local observation or felt report Seismic event greater than M2.0 and no felt report	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 well. 3. Review seismic and operational data. 4. Report findings to the UIC Program Director and issue corrective actions, if necessary.
Magenta	Seismic event greater than M2.0 and local observation or report	1. Initiate rate reduction plan. 2. Within 24 hours of the incident, notify the UIC Program Director, of the operating status of the well. 3. Communicate with facility personnel and local authorities to initiate evacuation plans, as necessary. 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. Determine if leaks to ground water or surface water occurred (CO_2 or brine). 6. If USDW contamination is detected: a. Notify the UIC Program Director within 24 hours of the determination. b. Follow plan of action as detailed in Section 4.4. 7. Review seismic and operational data. 8. Report findings to the UIC Program Director and issue corrective actions, if necessary.
Red	Seismic event greater than M2.0, and local observation or report, and local report and confirmation of damage. [4] Seismic event >M3.5	1. Initiate shutdown plan. 2. Within 24 hours of the incident, notify the UIC Program Director of the operating status of the well. 3. Communicate with facility personnel and local authorities to initiate evacuation plans, as necessary. 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. Determine if leaks to groundwater or surface water occurred. 6. If USDW contamination is detected: a. Notify the UIC Program Director within 24 hours of the determination. b. Follow plan of action as detailed in Section 4.4. 7. Review seismic and operational data. 8. Report findings to the UIC Program Director and issue corrective actions, if necessary.

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

[2] "Felt report" and "local observation and report" refer to events confirmed by local reports of felt ground motion or reported on the USGS "Did You Feel It?" reporting system.

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

[4] Onset of damage is defined as cosmetic damage to structures, such as bricks dislodged from chimneys and parapet walls, broken windows, and fallen objects from walls, shelves, and cabinets.

4.6. Unforeseen Events

Should unforeseen events occur (i.e., meteor strike, global pandemic, etc.) that could impact the operations and integrity of the program, response steps will be provided to the UIC Program Director and implemented once approved.

5. Response Personnel, Authorities, and Equipment

Site personnel, project personnel, and local authorities will be relied upon to implement this ERRP. The injection and monitoring wells are located in Madison County. As such, emergency contacts will be local responders from the area. Should there be an incident, the local responders will be notified as necessary. In addition, state agencies may need to be notified as well. Site personnel to be notified (not listed in order of notification):

1. Well Operator(s),
2. Control Room Operator(s),
3. Operations Manager,
4. HSE Manager,
5. Plant/General Manager.

All staff will be trained in the methods prescribed in Section 8 *Staff Training and Exercise Procedures* of this document. A site-specific emergency contact list will be developed, maintained, and periodically updated during the life of the project. The list will include phone numbers and email addresses for the facility emergency 24-hour contacts. Vault GSL CCS Holdings LP will provide the current site-specific emergency contact list to the UIC Program Director prior to commencement of injection operations. A contact for non-site specific local, state, and federal contacts is provided in Table 11.

Table 11: Local, state, and other authorities.

Agency	Phone Number
Police or Fire Emergency	911
Alexandria Fire Department	765-724-2195
Madison County Sheriff's Department	765-642-0221
Alexandria Police Department	765-724-3222
Indiana State Police District 51	800-527-4752 765-778-2121
Environmental services contractor to be determined (TBD)	TBD
Underground Injection Control (UIC) Program Director (Region 5)	312-353-7648
EPA Region 5 UIC Class VI Wells/Carbon Sequestration	312-353-3944
EPA National Response Center (24 hours)	800-424-8802
Indiana Department of Natural Resources	317-232-4200

Equipment required in the event of an emergency and remedial response will vary and depend upon the 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 workover rig or logging equipment, is required, Vault GSL CCS Holdings LP will be responsible for its procurement.

6. Emergency Communications Plan

Should an event occur that requires an emergency response, Vault GSL CCS Holdings LP will clearly communicate information about the event and any potential environmental or safety implications to the public. The amount of information, timing, and communications method(s) will be appropriate to the event, its severity, whether any impacts to USDWs or other environmental resources have occurred, any impacts to the surrounding community, and their awareness of the event.

Vault GSL CCS Holdings LP will describe what happened, describe 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), Vault GSL CCS Holdings LP will provide periodic updates about the progress of the response action(s).

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

The order of contact call-out should an emergency situation occur is as follows:

1. Project Operations Manager and Plant/Facility Manager,
2. Necessary emergency and EPA authorities,
3. Impacted landowners (if any),
4. Vault GSL CCS Holdings LP Management Teams,
5. Vault GSL CCS Holdings LP Public Response Personnel (as listed in Section 5 of this document).

Within 24 hours, following contact with the public response personnel, incidents will be reported to the Region 5 office staff assigned to the project.

Based on the appropriate level of emergency response and the magnitude of the event, a crisis event center will be established. For minor emergencies, this will be held at the wellsite. For major or serious emergencies, a crisis event center will be established at a safe location. This will serve as the headquarters for communication on the emergency. Vault GSL CCS Holdings LP will establish a liaison to communicate with the public and impacted landowners.

7. Plan Review

In accordance with 40 CFR 146.94(d), 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 a time to be determined as part of the permit following any significant changes to the injection process or the injection facility, or an emergency event, or
- As required by the permitting agency.

If the review indicates that no amendments to the ERRP are necessary, Vault GSL CCS Holdings LP will provide the permitting agency with 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 six months following an event that initiates the ERRP review procedure.

8. Staff Training and Exercise Procedures

Vault GSL CCS Holdings LP will develop a Standard Operating Procedure (SOP) in tandem with the contractors that provide the surface capture and compression equipment and the surface monitoring system to develop detailed operating procedures to be followed in the event of an emergency that will be supplied to all other contractors.

Included in this SOP will be specific details that can be used to train the project operators regarding the ERRP. Based on these SOPs, annual training and testing will be provided to all those involved with the project as well as those identified in Section 5 *Response Personnel, Authorities, and Equipment* of this document.

All personnel identified and assigned as response personnel in the document will complete initial training prior to the commencement of operations. This initial training, as well as annual certifications, will be documented and retained.

9. References

Attachment 01: Narrative, 2024, Underground Injection Control Class VI Permit Application: Aster Project.

Attachment 03: Financial Assurance Plan, 2024, Underground Injection Control Class VI Permit Application: Aster Project.

Indiana DNR, Historic Preservation & Archaeology, 2021, Indiana State Historic Architectural and Archaeological Research Database (SHAARD) & Indiana Historic Buildings, Bridges, and Cemeteries (IHBBC) Map: <https://www.in.gov/dnr/historic-preservation/county-survey-program/shaard-database/>.