EMERGENCY AND REMEDIAL RESPONSE PLAN
40 CFR 146.94(a)

Project Name: Tri-State CCS Buckeye 1

Facility Information

Facility contact: Tri-State CCS, LLC
14302 FNB Parkway
Omaha, Nebraska 68154
402-691-9500

Well locations: Carroll County, Ohio

Well Name	Latitude (WGS 84)	Longitude (WGS 84)
TB1-1	40.666280	-81.071522
TB1-2	40.645464	-81.015331
TB1-3	40.610714	-81.028986
TB1-4	40.511234	-81.025860

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22Cr-110	22% Chromium Duplex Stainless Steel with 110,000 Pounds per Square Inch Minimum Yield Strength
AoR	Area of Review
BOP	Blowout Preventer
BHP	Bottomhole Pressure
CBL	Cement Bond Log
CCSO	Carroll County Sheriff's Office
CO_2	Carbon Dioxide
DH	Downhole
DTS	Distributed Temperature Sensing
ESD	Emergency Shutdown
ERRP	Emergency and Remedial Response Plan
FRS	Facility Registry Service
HAZOP	Hazard and Operability
LOC	Loss of Containment
LOTO	Lockout / Tagout
M	Magnitude
ODNR	Ohio Department of Natural Resources
OAC	Ohio Administrative Code
OSHA	Occupational Safety and Health Administration
P&A	Plugged and Abandoned
PNL	Pulsed-Neutron Logs
PPE	Personal Protective Equipment
PVT	Pit Volume Totalizer
UIC	Underground Injection Control
USDW	Underground Source of Drinking Water
USGS	United States Geologic Survey
U.S. EPA	U.S. Environmental Protection Agency

1. Introduction

The purpose of this Emergency and Remedial Response Plan (ERRP) is to meet the requirements of 40 CFR 146.94. This document describes the actions that Tri-State CCS, LLC will take to address unplanned movement of the injection fluid or formation fluid in a manner that may endanger an underground source of drinking water (USDW) at Tri-State CCS Buckeye 1 in Carroll County, Ohio (the "project'). The described actions will be followed during the construction, operation, and post-injection site care periods of the permitted injection wells. This plan functions as an addition to emergency management plans associated with the operation and maintenance of surface facilities and is not intended to duplicate the requirements of those plans.

If Tri-State CCS, LLC obtains evidence that the injected Carbon Dioxide (CO_2) stream and/or associated pressure front may cause an endangerment to a USDW, Tri-State CCS, LLC will perform the following actions (40 CFR 146.94(b)):

1. Initiate shutdown plan for the injection well.
2. Take all steps reasonably necessary to identify and characterize any release.
3. Notify the 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: Tri-State CCS, LLC will immediately cease injection. However, in some circumstances, Tri-State CCS, LLC will, in consultation with the UIC Program Director, determine whether gradual cessation of injection (using the parameters set forth in Section 4 of the Summary of Requirements -- Class VI Operating and Reporting Conditions) is appropriate.

2. Local Resources and Infrastructure

Since the project's Area of Review (AoR) delineation is based on the 334-psi pressure threshold for the Rose Run Sandstone of the Knox Group plus a buffer of 1 mile, "nearby" resources and infrastructure are considered those that are within the AoR (Figure 1).

Nearby resources that may be affected as a result of an emergency event include: Underground Sources of Drinking Water (USDWs) as described in subsection 2.7 of the Application Narrative, Camp Conestoga Lake, Woheld Lake, Camp Echo Lake, Kilgore Lake, Tennessee Gas Lake, France Lake, Pipe Run, Wholebark Run, Pumpkin Run, Reeds Run, Cold Spring Run, Honey Run, Strawcamp Run, Frog Run, and numerous unnamed tributaries and wetlands (Figure 4 and Figure 5).

Land parcels within the project AoR are generally used for farming, residential, coal mining, oil and gas production, and manufacturing. Nearby infrastructure that may be affected as a result of an emergency includes: highways and county roads, airport, cemeteries, railroad, residences, transmission lines, water supply wells, oil and gas wells and pipelines, and hospitals, schools, residences, and roads associated with the village/municipality of Carrollton and many smaller size communities and neighborhoods. (Figure 2, Figure 3, Figure 4, and Figure 5).

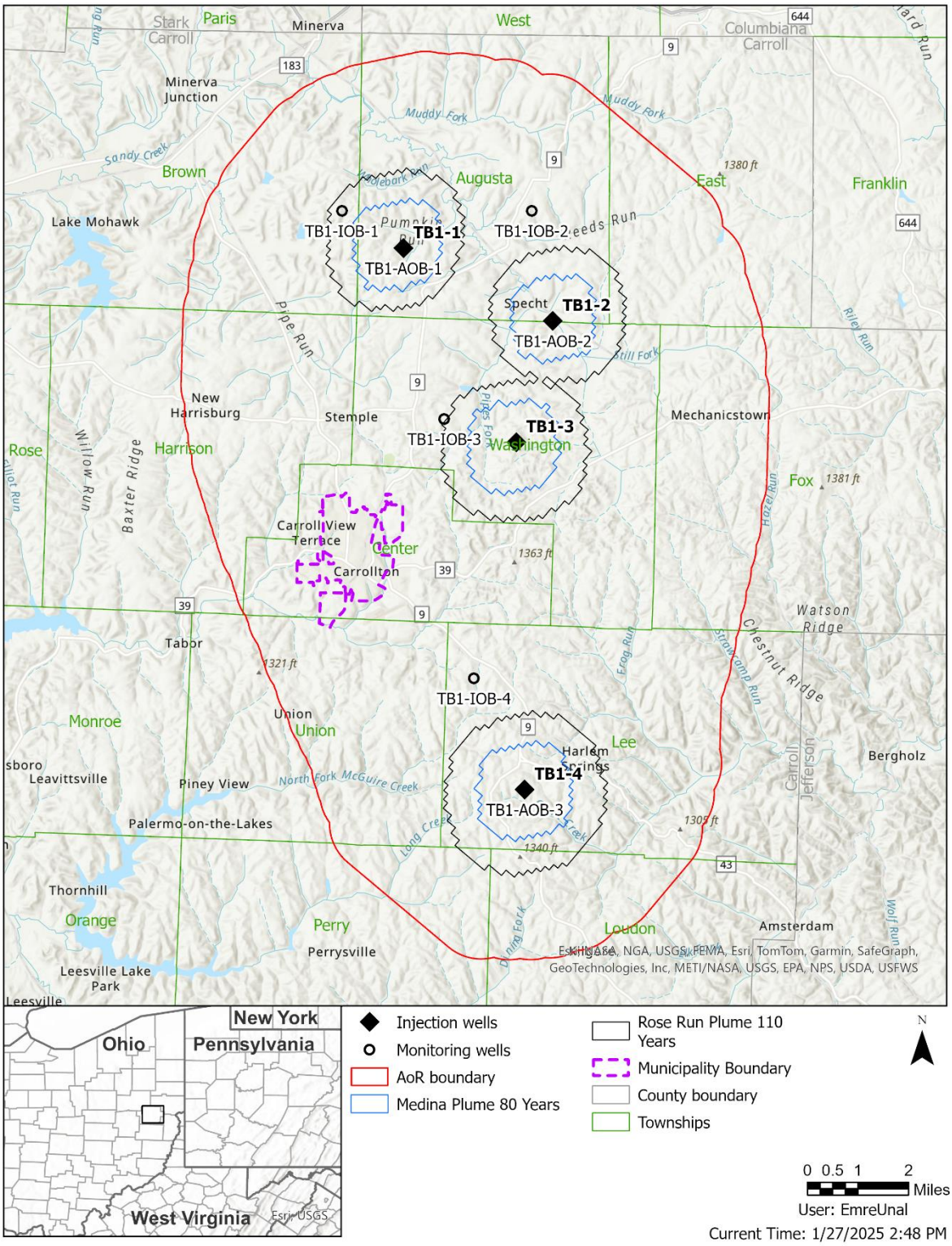

Figure 1: Map of the AoR, injection and monitoring wells, and plume at 110 years for Rose Run and 80 years for Medina with named streams shown.

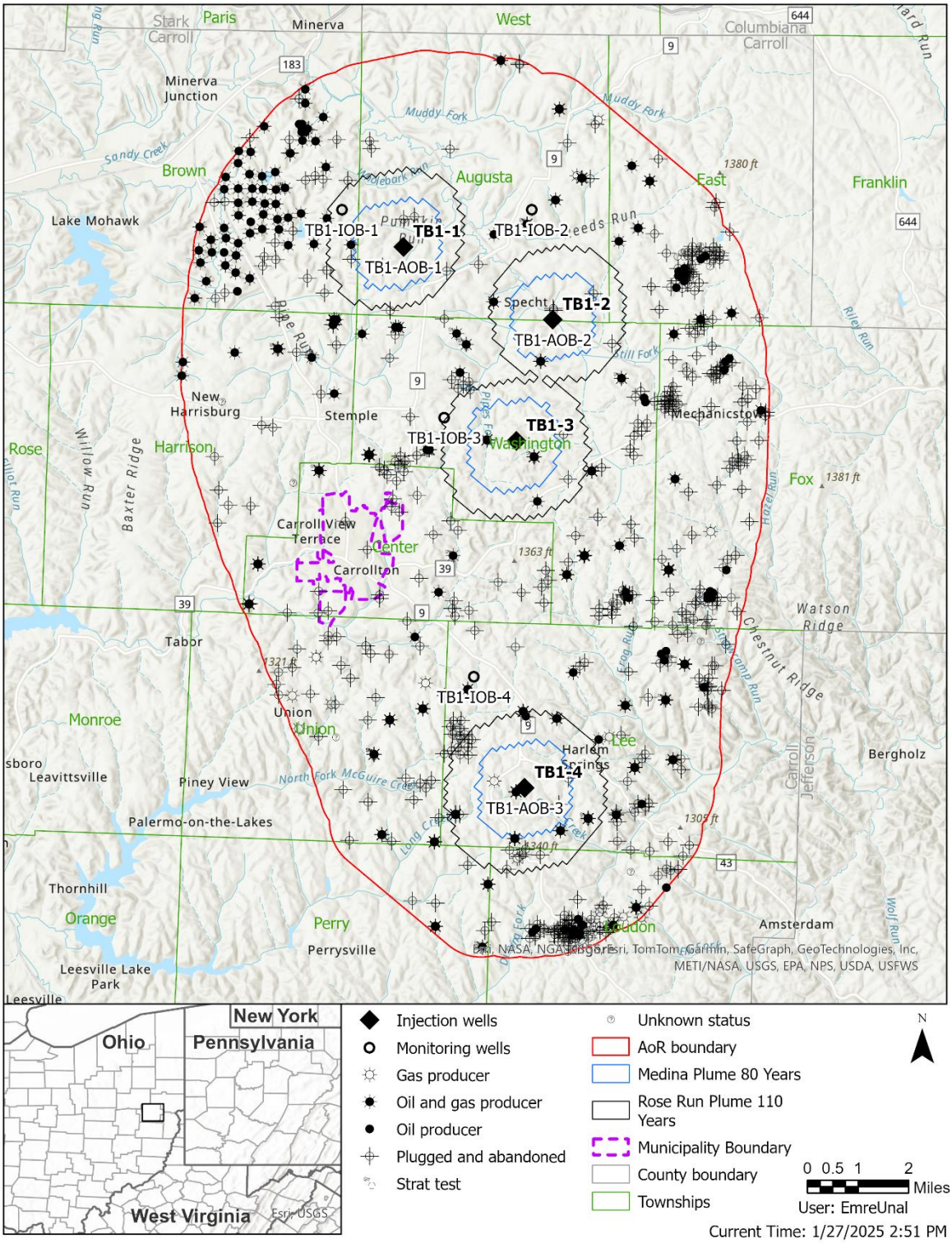

Figure 2: Map of the AoR, injection and monitoring wells, plume at 110 years for Rose Run and 80 years for Medina, and oil and gas wells.

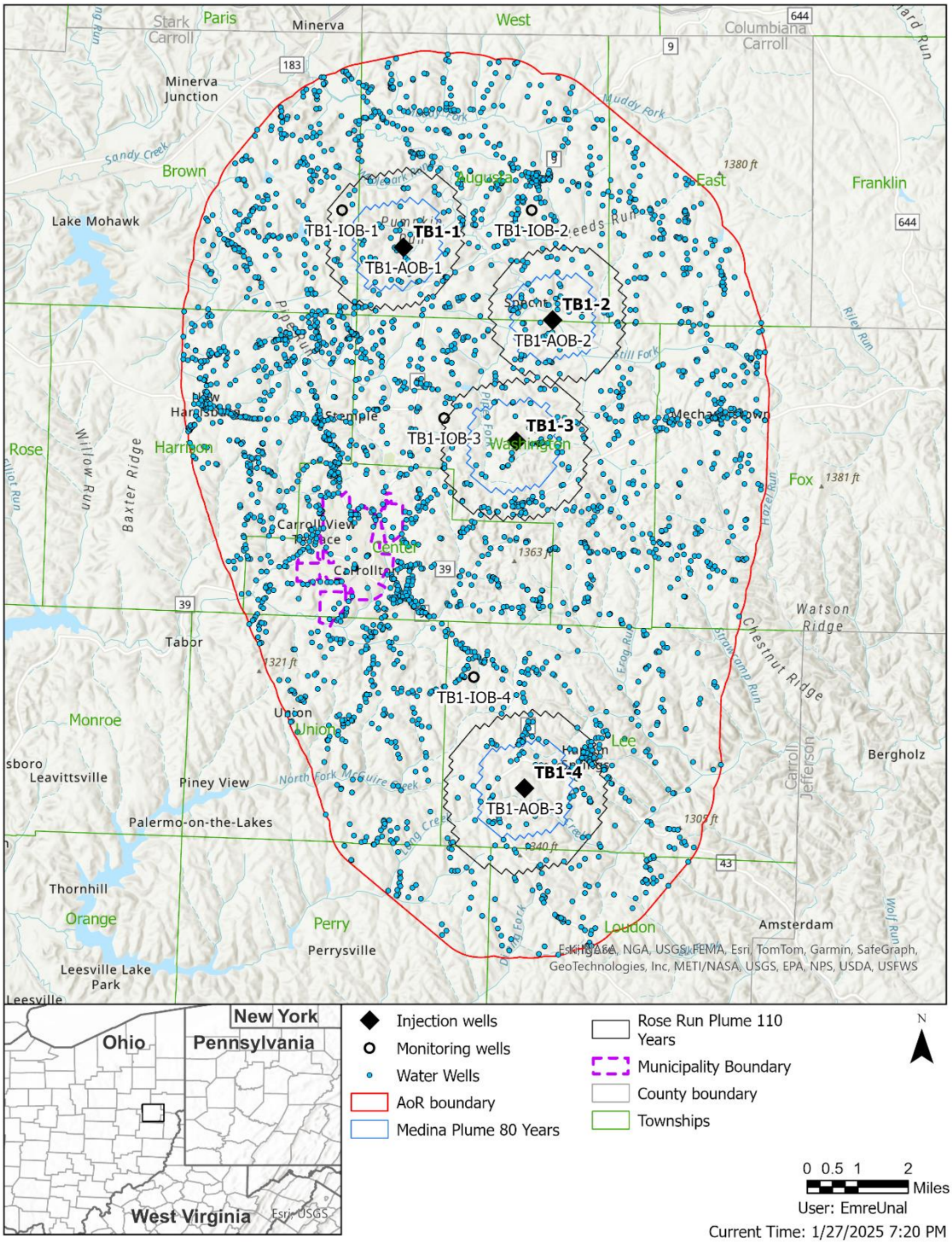

Figure 3: Map of the AoR, injection and monitoring wells, plume at 110 years for Rose Run and 80 years for Medina, and water wells.

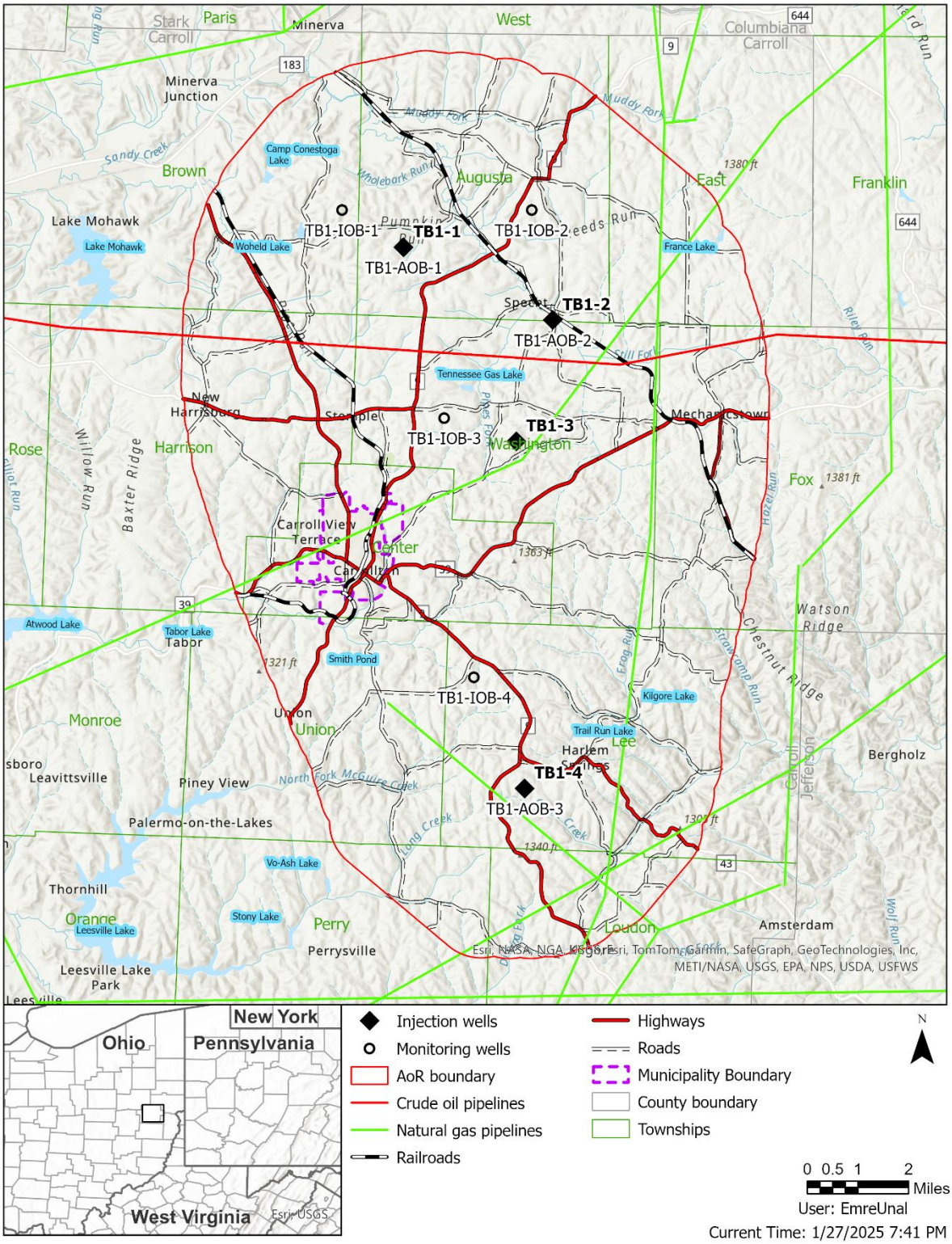

Figure 4: Map of the AoR, injection and monitoring wells, pipelines, roads, railroads, and lakes.

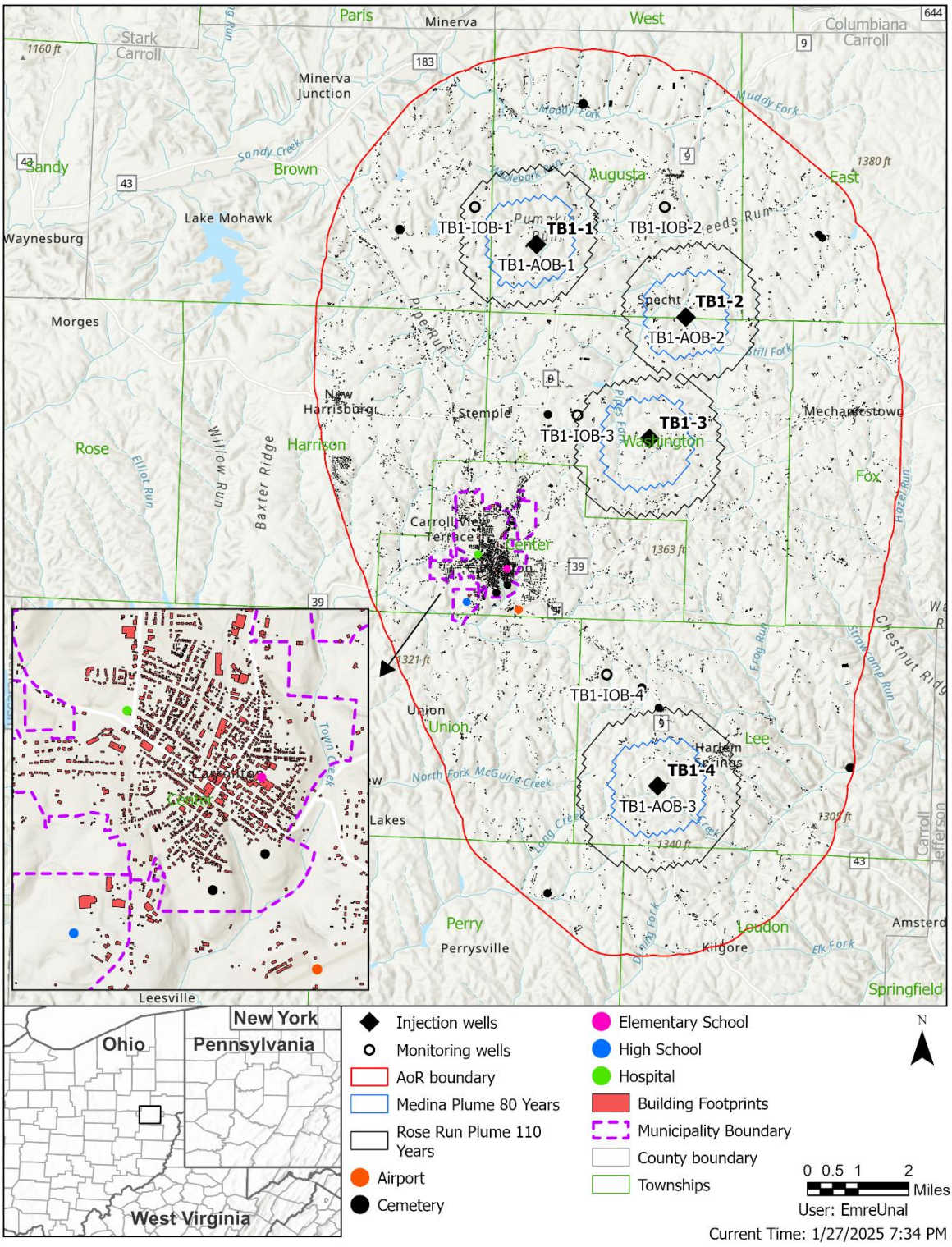

Figure 5: Map of the AoR, injection and monitoring wells, Rose Run plume at 110 years, Medina plume at 80 years, building footprints, other nearby infrastructure (airports, cemeteries, hospitals, prisons, and schools), and waterways.

3. Potential Risk Scenarios

The following is a list of events, related to the project, that could potentially result in an emergency response:

- Injection or monitoring (verification) well integrity failure;
- Injection well monitoring equipment failure (e.g., shut-off valve or pressure gauge, etc.);
- Fluid (e.g., brine) or CO_2 leakage to a USDW or the surface;
- A natural disaster (e.g., tornado, lightning strike, wildfire); or
- 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 1. A summary of the severity of the outlined scenarios in Appendix A along with their lookup numbers is shown in Table 2.

Table 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.

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Table 2: Summary of risk scenarios and their relative timing, degree of risk, and location in Appendix A.

Risk Scenario	Construction Period	Injection Period	PISC Period	Degree of Risk	Appendix A #
Fluid communication between formations while drilling	x			Serious to Major	1, 2, and 3
Fluid leakage into or near USDW or ground surface through wellbore (injection, monitoring, P&A, or other), surface equipment failure, faults, fractures, or confining zone failure		x	x	Minor to Major	4-7, 9-15
External impact to project wellheads or pipelines		x	x	Serious to Major	20-22
Loss of mechanical integrity (injection or monitoring well)	x	x	x	Minor to Major	4-7
Migration of CO_2 outside of defined AoR		x	x	Minor to Major	17-19
Injection or monitoring equipment failure/malfunction		x	x	Minor to Serious	23-28
Seismic event / earthquake (induced or natural)	x	x	x	Minor to Major	Table 4
Natural disaster (tornado, lightning, flood, wildfire)	x	x	x	Minor to Major	16, 29
Accident or unplanned event (e.g., electrical outage causing injection to stop, unauthorized activity)		x		Minor	8, 30-31

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 risk scenarios in Table 2, along with their corresponding response actions, are summarized in Appendix A, and emergency contact information is in Appendix B.

The appropriate course of action hinges upon both the emergency's nature and its severity, which should be determined as soon as possible but no later than 24 hours after the event. A comprehensive risk assessment will precede any request for operational permission, with a formal report on risk severity furnished to the UIC Program Director.

The potential risk scenarios specified in Table 2 and elaborated upon in Appendix A are conceptual in nature. Response plans may be subject to adjustment in collaboration with the UIC Program Director, considering the unique health, safety, and environmental factors of each situation.

4.1 Seismic Sensing

During injection, Tri-State CCS, LLC will monitor the pressure and plume and control injection rates (see Testing and Monitoring Plan); thus, it is unlikely that injection operations would induce a seismic event outside a ten (10) mile radius from the wellhead. Therefore, this portion of the response plan is developed for any seismic event with an epicenter within a ten (10) mile radius of the injection wells.

The seismicity of the region is discussed in subsection 2.6 of the Application Narrative. There have been six seismic instances within 50 miles of the injection locations over the last 40 years. The closest was 14.19 miles from the AoR, and the largest was a magnitude 4.0 on the Richter Scale (M4.0). The AoR is considered to have the lowest risk of damaging earthquakes on the United States Geologic Survey (USGS) scale, with fewer than 2 expected within a 10,000-year period. These data indicate that the AoR and surrounding area are tectonically stable (see Section 2 of the Application Narrative for additional details).

To monitor the area for seismicity, Tri-State CCS, LLC will rely on the established USGS and State real-time seismic monitoring networks. There are 7 stations within 50 miles of the permitted injection wells, shown in Figure 6 and detailed in Table 3. Data from these stations can be found here:

https://earthquaketrack.com/us-oh-carrollton/recent.

If a felt event is identified based on local reports, or a significant event is located at the injection site using the regional array ($M \geq 2.0$), Tri-State CCS, LLC will, in consultation with the UIC Program Director, develop an alternate seismicity monitoring plan using additional local geophone deployment. Additionally, microseismic monitoring will be utilized at the injection wellsites to assess and mitigate the induced seismicity risk through the duration of injection. Based on the periodic analysis of the monitoring data, according to the monitoring schedule, or as otherwise determined by the operator, observed level of seismic activity, and local reporting of felt events, the operator will assign the site an operating state (Table 4). The operating state designation is determined using threshold criteria that 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.

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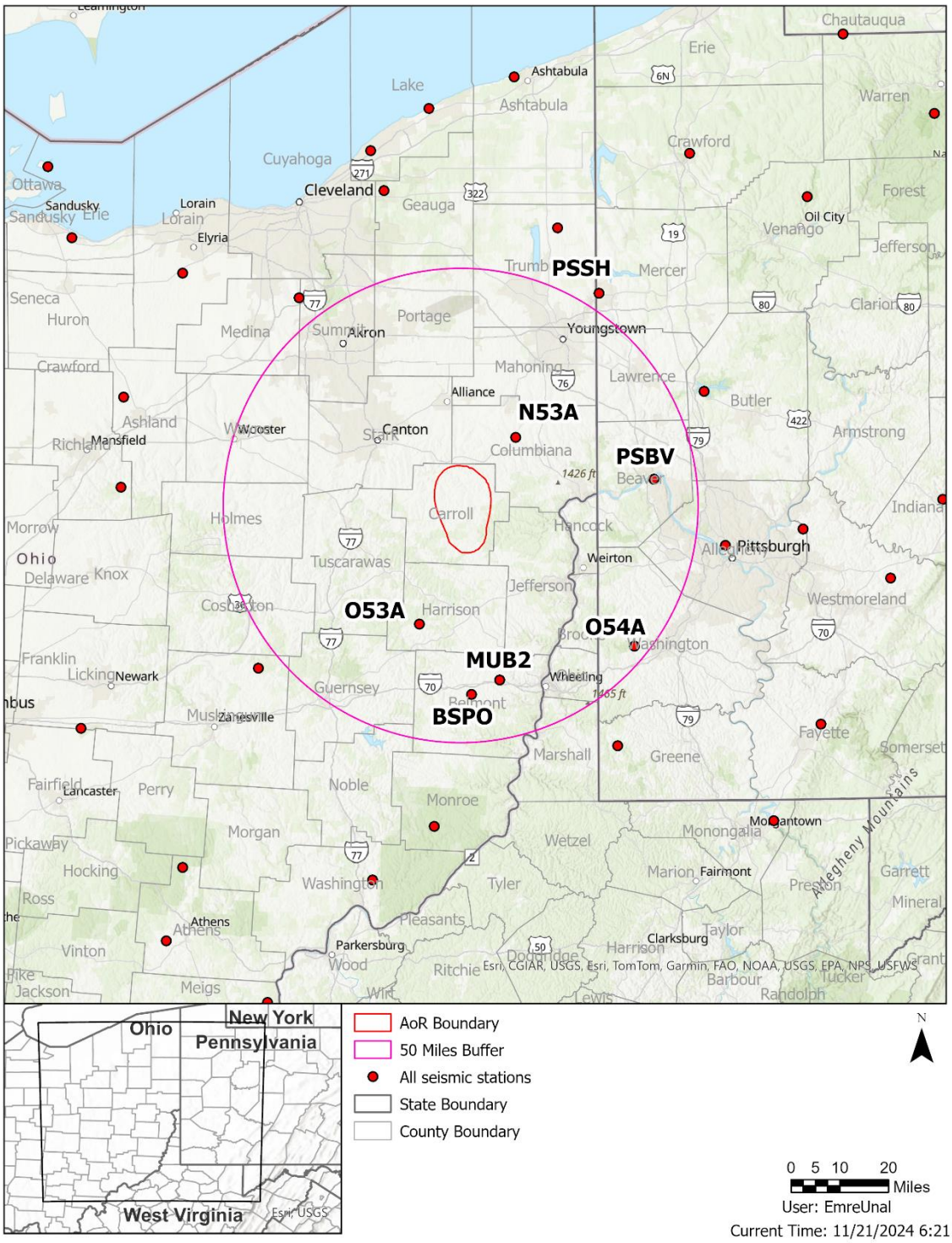

Figure 6: Map of AoR and USGS ANSS, PASEIS, and USArray seismic stations.

Table 3. Seismic Monitoring Stations within 50 Miles of the Injection Wells.

Station Code	Name	Lat	Long [1]	Network
PSSH	Penn State Shenango Campus, Sharon, PA	41.235	-80.5076	PASEIS
N53A	Lisbon, OH	40.8065	-80.8377	ANSS
PSBV	Penn State Beaver Campus, Monaca, PA	40.67995	-80.2975	PASEIS
O54A	Avella, PA	40.1821	-80.3778	USarray
MUB2	Belmont, OH	40.0835	-80.9002	PASEIS
BSPO	Barkcamp State Park, OH	40.0401	-81.0094	ANSS
O53A	New Philadelphia, OH	40.2493	-81.2129	UAarray

[1] WGS 84

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Table 4: Seismic monitoring system, for seismic events with an epicenter within a ten (10) mile radius of an injection well.

Operating State	Threshold Condition[1,2]	Response Action[3]
Green	Seismic events less than M2.0	1. Continue normal operation within permitted levels.
Yellow	Five (5) or more seismic events within a 30-day period having a magnitude less than or equal to M2.0	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.
Orange	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.

[1] Specified magnitudes refer to magnitudes determined by USGS seismic monitoring stations or reported by the USGS National Earthquake Information Center using the national seismic network. *USGS open file report 2008-1262*.

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

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

Operating State	Threshold Condition[1,2]	Response Action[3]
Magenta	Seismic event greater than M2.0 and local observation or report	1. Initiate rate reduction plan. 2. Vent CO_2 from surface facilities if required. 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 groundwater or surface water occurred. 8. If USDW contamination is detected: a. Notify the UIC Program Director within 24 hours of the determination. b. Initiate Shutdown Plan. c. Shut in well (close flow valve) d. Vent CO_2 from surface facilities e. Identify and implement appropriate remedial actions (in consultation with UIC Program Director) 9. Review seismic and operational data. 10. Report findings to the UIC Program Director and issue corrective actions.
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. Vent CO_2 from surface facilities if required. 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. If USDW contamination is detected: a. Notify the UIC Program Director within 24 hours of the determination. b. Identify and implement appropriate remedial actions (in consultation with the UIC Program Director). 9. Review seismic and operational data. 10. Report findings to the UIC Program Director and issue corrective actions.

[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.

5. Response Personnel and Equipment

The Project Manager during construction or the Operations Manager during operation and post-injection site care is responsible for implementing this ERRP. Project personnel and local authorities will also be relied upon to implement this ERRP.

The Project Manager during construction or the Operations Manager during operation and post-injection site care is the 24-Hour Emergency Contact for the project. A site-specific emergency contact list (Appendix B) will be maintained during the life of the project and will be updated at least annually as described in Section 6 below.

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, Tri-State CCS, LLC will be responsible for procurement of any necessary additional specialized equipment (e.g., drilling rigs or logging equipment).

6. Emergency Communications Plan

In the event of an emergency requiring outside assistance, project personnel will notify the 24-Hour Emergency Contact identified in Appendix B of this ERRP as soon as possible after requesting outside assistance from local emergency responders. Tri-State CCS, LLC will maintain site-specific maps of well locations and access roads that will be readily available for local emergency responders.

In the event of any of the following that may be applicable to the project, Tri-State CCS, LLC shall immediately notify the Ohio Department of Natural Resources (ODNR) at 1-844-642-2551 within 30 minutes of becoming aware of the occurrence, with a follow-up written report within 30 days: (OAC 1501:9-8-02)

- Any release of gas that threatens public safety;
- Fire or explosion at the facility, exept for subsurface detonation of perforation guns, seismic shorts, and controlled blasting for well site construction;
- Release outside of secondary containment of greater than 25 gallons within a 24-hour period, or in an amount that causes a film or sheen on a surface water of the State, of refined oil product, including but not limited to oil-based drilling fluid, petroleum distillate, spent or unused paraffin solvent, asoline, fuel oil, diesel fuel, or lubricants; or
- Release outside of secondary containment of greater than 42 gallons within a 24-hour period of semi-solid wastes, including drilling mud and sludge.

Forms for the initial notification and 30-day follow-up report are available at the following website:

https://ohiodnr.gov/discover-and-learn/safety-conservation/about-odnr/oil-gas/programs-sections/emergency-ops-response

Tri-State CCS, LLC 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. This may include working closely with the Carroll County Sheriff's Office (CCSO) to activate the County's emergency notification system (CCSO Alerts!) and/or local broadcasting and news agencies in Carroll County and the region. Tri-State CCS, LLC will describe what happened, any actual or potential impacts to the environment or other local resources, how the event was investigated, what responses were taken, and the status of the response. 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. For emergency responses that require ongoing action, Tri-State CCS, LLC will provide periodic updates on progress to local broadcasting and new agencies to be communicated to the public.

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

7. Plan Review

This ERRP shall be periodically reviewed as follows:

- At least once every five (5) years following its approval by the UIC Program Director;
- Within one (1) year of an AoR reevaluation;
- Following any significant changes to the injection process or the injection facility, or an emergency event; or
- As required by the UIC Program Director; and
- At least annually for the Emergency Contact List in Appendix B of this ERRP.

An amended ERRP should be submitted to the UIC Program Director within one (1) year of an AoR reevaluation, following any significant changes to the facility, or when required by the UIC Program Director. Amendments must be approved by the UIC Program Director and incorporated into the permit and are subject to permit modification requirements. If the review indicates that no amendments to the ERRP are necessary, Tri-State CCS, LLC will provide the UIC Program Director with the documentation supporting the "no amendment necessary" determination. Updating the Emergency Contact List and clarifications or corrections are not considered an amendment to the ERRP and do not require permit modification (40 CFR 144.41).

8. Staff Training and Exercise Procedures

Tri-State CCS, LLC will integrate the ERRP into its existing operating procedures and training protocols. Tri-State CCS, LLC will determine the required training programs for each employee commensurate with their job function, safety requirements, and regulatory requirements. All employees working at the project will be trained—this training will be documented prior to commencing injection. Tri-State CCS, LLC will hold safety meetings with each contractor prior to commencement of any new contract work on the project with emergency measures specific to the contractor's work explained. Tri-State CCS, LLC will provide information about employee

training status, schedules, and coursework to regulatory authorities upon request and prior to commencing injection.

Tri-State CCS, LLC intends to provide training courses for field personnel that may include, but are not limited to:

- Emergency action planning
- Hazard communication (HAZCOM)
- Basic fire extinguishers
- Major emergency response
- OSHA 10-hour and 30-hour general industry
- Risk management for oil and gas field operations

Periodic training will be provided, not less than annually, to construction personnel, well operators, maintenance personnel, 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.

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Appendix A: Emergency Remedial and Response Risk Scenarios

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
1	Construction Period	Fluid Leakage - Drilling operations: Hydrostatic column controlling the well decreases below the formation pressure, resulting in a sudden influx of fluid, causing a well control event with loss of containment.	• Flow sensor • Pressure sensor • Tank level indicator • Tripping displacement practices • Mud weight control	• Blowout prevention (BOP) equipment • Kill fluid • Well control training • BOP drills • BOP testing protocol • Kick drill • Lubricators for wireline operations	**Drilling:** • Stop operation • Close BOP • Clear floor and secure area • Execute well control procedure • Evaluate drilling parameters to identify root cause • If release of drilling fluid is > 42 gal, notify ODNR at 1-844-642-2551 within 30 min • If major emergency, call 911 • Notify 24-Hour Emergency Contact and UIC Program Director and propose an action plan based on the finding • Continue operations **Completion:** • Stop operations • Close BOP • Clear floor and secure area • Execute well control procedure • If release of drilling fluid is > 42 gal, notify ODNR at 1-844-642-2551 within 30 min • If major emergency, call 911 • Notify 24-Hour Emergency Contact and UIC Program Director and propose remediation plans. • Continue operations • In case of influx, control the well, without compromising the shoe integrity • In the case of the shoe leaking, squeeze to regain integrity • In the case of the surface casing leaking, squeeze or install a casing patch	• Project manager • Rig crew • Rig manager • Field superintendent

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
2	Construction Period	Fluid Leakage - Drilling operations: Failure of surface casing completion to protect USDW while drilling resulting in cross flow of brine between formations resulting in fluid losses into the underground source of drinking water (USDW).	• Pressure sensors • Cement bond log (CBL) • Rig pit volume totalizer (PVT) system	• Pressure sensors • USDW will be covered with casing(s) cemented to surface • Casing test after cementing surface casing to check integrity • CBL to check cement bonding	• In case of influx, control the well, without compromising the shoe integrity • In the case of the shoe leaking, squeeze to regain integrity • If release of drilling fluid is > 42 gal, notify ODNR at 1-844-642-2551 within 30 min • If major emergency, call 911 • In the case of the surface casing leaking, squeeze or install a casing patch. • Notify 24-Hour Emergency Contact and UIC Program Director and propose remediation plans.	• Project manager • Rig crew • Rig manager • Field superintendent
3	Construction Period	Unauthorized access/activity: Unauthorized activity on field site	• Field personnel logs	• Fencing around well sites • Security in place	• Notify 24-Hour Emergency Contact • Report any incidents to local Sheriff's office	• Field superintendent • Company man
4	Construction Period	Fluid Leakage - Drilling through USDW: Improper well control during the drilling of one or more monitoring or injection wells. Excessive overbalance exceeds the aquifer reservoir or fracture propagation pressure, and the drilling fluid migrates into the USDW. Improperly handled kick from loss of overbalance causes formation failure in USDW.	• Flow sensor • Pressure sensor • Mud weight control • Rig pit volume totalizer (PVT) system	• Well control training • Overbalance mud program • Sufficient drilling fluid reserve • Rig solids control system	• Suspend drilling operation • Close BOP • Clear floor and secure area • Execute well control procedure • Evaluate drilling parameters to identify root cause • If release of drilling fluid is > 42 gal, notify ODNR at 1-844-642-2551 within 30 min • If major emergency, call 911 • Notify 24-Hour Emergency Contact and UIC Program Director and propose remediation plans • Implement corrective actions • Continue operations	• Project manager • Rig crew • Rig manager • Field superintendent
5	Injection Period	Fluid Leakage – UIC Wellbores: A loss of mechanical integrity in the injection well causing a tubing/packer to leak due to corrosion damage, damage to the tubulars during installation, fatigue, higher load profiles, and other issues, that could cause communication of formation fluids with the annular casing tubing as well as sustained casing pressure. There is no loss of containment (LOC) in this scenario.	• Pressure gauges on surface and downhole real time • Pulsed-neutron logs • Annular pressure test • CO_2 leak sensors on the wellhead	• 22Cr-110 grade duplex stainless steel (22Cr-110) or lined carbon steel string tubing • Inhibited packer fluid in annulus • Corrosion monitoring plan • Dry CO_2 injected • 22Cr-110 or higher alloy packer • 22Cr-110 or higher alloy carrier for sensors • New tubing or inspection of tubing before reinstallation • Cased hole logging program	• Trigger Emergency Shutdown system • SCADA alarms notification to operations staff • Follow protocol to stop operation, vent, or deviate CO_2 • Notify 24-Hour Emergency Contact • Troubleshoot the well • If tubing leak is detected, notify UIC Program Director and propose an action plan based on the finding • Schedule well service to repair tubing	• Operations manager • Field superintendent • Project manager

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
6	Injection/ Post Injection Site Care Period	Fluid Leakage – Monitoring Well Wellbores: A loss of mechanical integrity in the monitoring well causing a tubing/packer to leak due to corrosion damage, damage to the tubulars during installation, fatigue, higher load profiles, and others and could cause a communication of the formation fluids with the annular casing tubing as well as sustained casing pressure. There is no loss of containment (LOC) in this scenario.	• Pressure gauges on surface and downhole real time • Pulsed-neutron logs • Annular pressure test • CO_2 leak sensors on the wellhead	• 22Cr-110 or lined carbon steel string tubing • Inhibited packer fluid in annulus • Corrosion monitoring plan • 22Cr-110 or higher alloy packer • 22Cr-110 or higher alloy carrier for sensors • New tubing or inspection of tubing before reinstalling • Cased hole logging program • Observation wells are designed to be outside of the projected plume for most of the project which reduces the risk of contact with CO_2	• Trigger Emergency Shutdown system • SCADA alarms notification to operations staff • Notify 24-Hour Emergency Contact • Troubleshoot the well • Notify UIC Program Director and propose an action plan for well service • Schedule well service to repair tubing, isolate CO_2 zone, or abandon the well	• Operations manager • Field superintendent • Project manager • Rig crew and downhole (DH) contractors
7	Injection Period	Fluid Leakage – UIC Wellbores: A loss of mechanical integrity in the injection wells causing a casing leak due to corrosion, damage in the tubulars during installation, fatigue, higher load profiles, or others. This event could cause migration of CO_2 and brines through the casing, the cement sheet, and into different formations of the injection target or into USDW.	• Pressure gauges on surface and downhole real time • CO_2 leak sensors on the wellhead • Distributed Temperature Sensing (DTS) fiber real time alongside the casing • Flow rate monitoring • Pulsed-neutron logs • CBL/Ultra-sonic logging • USDW water monitoring	• CO_2-resistant cement and metallurgic across injection zone • Injection through tubing and packer • Inhibited packer fluid in the annular • Cement to surface • Corrosion monitoring plan • Cased hole logging program • New casing and tubing installed	• Trigger Emergency Shutdown system • SCADA alarms notification to operations staff • Follow protocol to stop operation, vent, or deviate CO_2 • If public safety is threatened, notify ODNR at 1-844-642-2551 within 30 min • If major emergency, call 911 • Notify 24-Hour Emergency Contact • Troubleshoot the well. • Evaluate if there is a movement of CO_2 or brines to USDW. In the remote event that USDW is affected, discuss remediation options with the UIC Program Director • Notify UIC Program Director and propose an action plan based on the finding and location of the leak • Schedule well service to repair the casing	• Operations manager • Field superintendent • Project manager • Rig crew and DH contractors • Remediation contractors
8	Injection period	Unauthorized access/activity: Unauthorized activity on field site	• Field personnel logs	• Fencing around well sites • Security in place	• Notify 24-Hour Emergency Contact • Report any incidents to local Sheriff's office	• Field superintendent • Company man

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
9	Injection Period/ Post Injection Site Care Period	Fluid Leakage – Monitoring Well Wellbores: A loss of mechanical integrity in the monitoring well causing a casing leak due to corrosion, damage in the tubulars during installation, fatigue, higher load profiles, and others. This event could cause a migration of CO_2 and brines through the casing, the cement sheet, and into different formations of the injection target or into USDW.	• Pressure gauges on surface and downhole real time • CO_2 leak sensors on the wellhead • Pulsed-neutron logs • CBL/Ultra-sonic logging • USDW water monitoring	• CO_2-resistant cement across injection zone • 22Cr-110 or higher alloy packer • Inhibited packer fluid in the annular • Cement to surface • Corrosion monitoring plan • Cased hole logging program • New casing • New or inspected tubing before reinstallation • Observation wells are designed to be outside of the projected plume for most of the project's life cycle which minimizes the risk of contact with CO_2	• Trigger Emergency Shutdown system • SCADA alarms notification to operations staff • If public safety is threatened, notify ODNR at 1-844-642-2551 within 30 min • If major emergency, call 911 • Notify 24-Hour Emergency Contact • Troubleshoot the well • Evaluate if there is a movement of CO_2 or brines to USDW. In the remote event that USDW is affected, discuss remediation options with the UIC Program Director • Notify UIC Program Director and propose an action plan based on the findings and the location of the leak. • Schedule well service to repair the casing	• Operations manager • Field superintendent • Project manager • Rig crew and DH contractors • Remediation contractors
10	Injection Period / Post Injection Site Care Period	Fluid Leakage – Legacy Wellbores: Brines and CO_2 could migrate through poor cement bonding, cement degradation, or cracking in the cement of plugged and abandoned (P&A) wells.	• USDW water sampling • Pulsed-neutron logs	• Legacy wells are properly abandoned for brine movement because of pressurization of injection zone • Injectors will be abandoned as soon as CO_2 injection ends, except if they are left as observation wells	• If public safety is threatened, notify ODNR at 1-844-642-2551 within 30 min • If major emergency, call 911 • Notify 24-Hour Emergency Contact • Evaluate if it's a positive CO_2 release because of a leak in the legacy/P&A well • Notify regulator and propose plan to repair the well, delineate the area, and identify potential resources affected	• Operations manager • Field superintendent • Project manager • Rig crew and DH contractors • Remediation
11	Injection	Fluid Leakage – Faults and Fractures: During injection, the pressurization of the injection zone exceeds the sealing capacity of the confining zone above or if there are features such as fault or fractures that are reactivated. Creating a leakage pathway for CO_2 and brine to migrate to a shallower formation, including a USDW.	• USDW water sampling • Pulsed-neutron log in injector and observation wells	• Injection is limited to 90% of frac gradient • Extensive characterization of the rocks shows good sealing capacity • If the confining zone above the Medina fails, the Salina Group will act as a buffer formation before CO_2 or brines are able to reach the USDW.	• If public safety is threatened, notify ODNR at 1-844-642-2551 within 30 min • If major emergency, call 911 • Notify 24-Hour Emergency Contact • Assess root cause by reviewing monitoring data • Notify UIC Program Director • If necessary, follow protocol to stop injection. • If necessary, conduct geophysical survey to delineate potential leak path • Evaluate if there is a movement of CO_2 or brines to USDW. If USDW is affected, discuss with UIC Program Director remediation options, action plan, and monitoring program. • Actions to restore injection will depend on the nature of the leak path and the extent. Operator needs to reevaluate model and discuss action plan with UIC Program Director	• Operations manager • Field superintendent • Geologist • Reservoir engineer • Project manager • Remediation contractors

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
12	Injection Period	Fluid Leakage - Geomechanical Seal Failure Elevated well bottomhole pressure (BHP) either exceeds the permitted maximum injection pressure or the estimated maximum injection pressure is inaccurate (i.e., the true fracture pressure is lower than the estimated maximum pressure) in the injection zone, resulting in the failure of the confining system and leading to vertical migration of CO_2 or brine to a USDW, the surface or atmosphere (CO_2 only).	• Pressure gauges on surface and downhole real time • USDW water sampling • Pulsed-neutron log in injector and observation wells	• Injection is limited to less than 90% of the fracture gradient • Core and geomechanical testing and geochemical modeling of the upper confining zone show good sealing capacity and fluid compatibility, respectively • If the confining zone above the Medina fails, the Salina Group will act as a buffer formation before CO_2 or brines are able to reach the USDW. • Microfracture test prior to receiving authorization to operate, confirm formation breakdown pressure.	• Trigger Emergency Shutdown system • SCADA alarms notification to operations staff • Follow protocol to stop injection • Designate an exclusion zone, and provide appropriate PPE for protection of onsite personnel • If public safety is threatened, notify ODNR at 1-844-642-2551 within 30 min • If major emergency, call 911 • Notify 24-Hour Emergency Contact • Assess root cause by reviewing monitoring data • If required, conduct geophysical survey to delineate potential leakage pathway • Evaluate if there is a movement of CO_2 or brines to USDW. • Notify UIC Program Director and propose remediation options, action plan, and monitoring program • Actions to restore injection will depend on the nature of the leak path and the extent. Operator needs to reevaluate model and discuss action plan with UIC Program Director	• Operations manager • Field superintendent • Monitoring staff • Geologist • Reservoir engineer • Project manager • Remediation contractors
13	Injection Period	Fluid Leakage - Surface Infrastructure: Vehicle strikes other surface equipment (e.g., tank battery pumps/compressors, etc.), causing the release of CO_2 at the surface.	• Use of protective equipment, such as bollards, fences, locking gates • Use of appropriate fencing and signage	• Temperature-controlled building and/or containment, as required by regulation or law, will be proposed to protect the surface equipment and other instrumentation (i.e., interrogator, gauges, meters, etc.).	• Trigger Emergency Shutdown system • SCADA alarms notification to operations staff • Designate an exclusion zone, and provide appropriate personal protective equipment (PPE) for protection of onsite personnel • If public safety is threatened, notify ODNR at 1-844-642-2551 within 30 min • If major emergency, call 911 • Follow protocol to shut down CO_2 delivery • If there are injured personnel, call emergency team, and execute evacuation protocol • Notify 24-Hour Emergency Contact • Clear location and secure the perimeter. If possible, install containment devices around the location. • Evaluate environmental impact (soil, water, fauna, vegetation), • Assess mechanical integrity of the system • Notify UIC Program Director and	• Operations manager • Field superintendent • Project manager • Plant manager • Remediation contractors

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
					propose repair actions • Repair or replace equipment	
14	Injection Period	Fluid Leakage - Surface Infrastructure: Failure of a valve results in leakage of CO_2 with potential impacts to health, safety, and the environment, particularly if the leak is not detected and corrected.	• Routine field inspections • Routine inspection of emergency alert systems, monitoring systems and controls.	• Equipment upstream or downstream of the failed valve can be used to isolate the problem as necessary • Preventative maintenance • Periodic inspections	• Trigger Emergency Shutdown system • SCADA alarms notification to operations staff • If public safety is threatened, notify ODNR at 1-844-642-2551 within 30 min • If major emergency, call 911 • If there are injured personnel, call emergency team, and execute evacuation protocol • Notify 24-Hour Emergency Contact • Clear location and secure the perimeter. • Evaluate environmental impact • Assess mechanical integrity of the system • Notify UIC Program Director and propose repair actions • Repair or replace equipment	• Operations manager • Field superintendent • Plant manager • Remediation contractors • Emergency teams
15	Injection Period	Fluid Leakage – Surface Infrastructure: The CO_2 stream is blocked between valves on the surface, heated (e.g., by the sun), and expands to rupture the line or flowline on the site is plugged and the pressure sensor fails to detect the change, resulting in a CO_2 leak.	• Pressure, temperature, and flowmeter sensors in real time • Field inspections	• Relief valves (e.g., Pressure Safety Valves) in areas where this is a risk as part of the design process • Equipment upstream or downstream of the failed valve can be used to isolate the problem as necessary • Cleaning protocols: - Wiping the lines- Testing with water - Performing cleaning runs to remove any debris. • Witches hat (cone strainer) filters can be used to filter out large pieces of debris on startup	• Trigger Emergency isolation valves • SCADA alarms notification to operations staff • Follow protocol to shut down CO_2 delivery • If public safety is threatened, notify ODNR at 1-844-642-2551 within 30 min • If major emergency, call 911 • If there are injured personnel, call emergency team, and execute evacuation protocol • Notify 24-Hour Emergency Contact to activate emergency plan, reverse 9-1-1 protocol for residents or occupants in proximity to occurrence. • Clear location and secure the perimeter. If possible, install containment devices around the location • Evaluate environmental impact (soil, water, fauna, vegetation), • Assess mechanical integrity of the system • Notify UIC Program Director and propose repair actions • Repair or replace equipment	• Operations manager • Field superintendent • Plant manager • Remediation contractors

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
16	Injection Period	Fluid Leakage – Natural Disaster: A natural disaster event - e.g., hurricane, lightning, tornadoes, floods, landslides – impacts the pipelines or flowlines at the storage location, forcing the release of CO_2 at the surface.	• Pressure and flowmeter sensors in real time • Field inspections	• Hazard and Operability (HAZOP) review • Emergency shutdown (ESD) valve installed near the wellhead so it will cease injection if any leak occurs downstream or upstream of the ESD • Weather monitoring	• Trigger Emergency isolation valves • SCADA alarms notification to operations staff • Follow protocol to shut down CO_2 delivery if the automatic shutoff device is not functional • If public safety is threatened, notify ODNR at 1-844-642-2551 within 30 min • If major emergency, call 911 • If there are injured personnel, call emergency team, and execute evacuation protocol • Notify 24-Hour Emergency Contact • Clear the location and secure the perimeter. If possible, install containment devices around the location. • Assess mechanical integrity of the pipelines or flowlines • Notify UIC Program Director and propose action plan • Evaluate environmental impact (soil, water, fauna, vegetation), and present remediation plan to the UIC Program Director for approval • Execute remediation, and install additional monitoring system as needed	• Operations manager • Field superintendent • Project manager • Remediation contractors • Emergency teams
17	Injection Period	Fluid Leakage – Surface Infrastructure: Failure of CO_2 transport flowlines from the CO_2 capture system to Tri-State CCS Hub CO_2 Injection wellhead.	• Surface pressure gauges and flowmeters at inlet and delivery point.	• Preventive maintenance • Periodic inspections • Monitoring devices at both ends of the transmission pipeline and flowline	• Trigger emergency isolation valves • SCADA alarms notification to operations staff • Follow protocol to shut down CO_2 delivery • Detect CO_2 stream release and its location • If public safety is threatened, notify ODNR at 1-844-642-2551 within 30 min • If major emergency, call 911and initiate evacuation plan • Notify 24-Hour Emergency Contact • Transmission line and/or flowline failure will be inspected to determine the root cause of the failure • Notify UIC Program Director and propose action plan • Repair/replace the damaged transmission line or flowline, and if warranted, put in place the measures necessary to eliminate such events in the future	• Operations manager • Field superintendent • Remediation contractors • Emergency teams • Plant manager/ • contact

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
18	Injection Period	Loss of Containment - Vertical Migration via injection well: During the life of the injector wells, there are induced stresses and chemical reactions on the tubulars and cement exposed to the CO_2 pressure and plume. Changes in temperature and injection pressure create stresses in the tubulars trying to expand or contract, and it can lead to microannulus effects, resulting in fugitive movement of brines/CO_2.	• CO_2 leak sensors on the wellhead • DTS fiber real time alongside the casing • USDW water monitoring • Pulsed-neutron logs (PNL) to be run for external integrity • CBL/Ultra-sonic logging • Pressure gauges at surface • Flow rate monitoring	• CO_2-resistant cement and metallurgy across injection zone • Injection through tubing and packer • 22Cr-110 or lined carbon steel string tubing • 22Cr-110 or higher alloy packer • Cement to surface • Cased hole logging program • USDW covered as second barrier with surface casing and surface cement sheet • New casing installed, 22Cr-110 or higher alloy	• Trigger Emergency Shutdown system • SCADA alarms notification to operations staff • Follow protocol to stop operation, vent, or deviate CO_2 • If major emergency, call 911 • Notify 24-Hour Emergency Contact • Troubleshoot the well • Evaluate if there is a movement of CO_2 or brines to USDW. • Notify UIC Program Director and discuss action plan to repair the well or P&A based on the findings of the assessment	• Operations manager • Field superintendent • Project manager • Rig crew and DH contractors • Remediation contractors
19	Injection Period/ Post Injection Site Care Period	Loss of Containment - Vertical Migration via monitoring well: During the life of the injector wells, there are induced stresses and chemical reactions on the tubulars and cement exposed to the CO_2 pressure and plume. Changes in temperature and injection pressure create stresses in the tubulars trying to expand or contract, and it can lead to microannulus effects, resulting in fugitive movement of brines/CO_2	• CO_2 leak sensors on the wellhead • USDW water monitoring • Pulsed-neutron logs to be run for external integrity • CBL/Ultra-sonic logging • Pressure gauges at surface	• CO_2-resistant cement across injection zone • Cement to surface • Cased hole logging program • USDW covered as second barrier with surface casing and surface cement sheet • New casing installed, 22Cr-110 or higher alloy • Observation wells are designed to be outside of the plume for most of the injection period	• Trigger Emergency Shutdown system • SCADA alarms notification to operations staff • If major emergency, call 911 • Notify 24-Hour Emergency Contact • Troubleshoot the well. • Evaluate if there is a movement of CO_2 or brines to USDW. • Notify UIC Program Director and discuss action plan to repair the well or P&A based on the findings of the assessment	• Operations manager • Field superintendent • Project manager • Rig crew and DH contractors • Remediation contractors

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
20	Injection Period/ Post Injection Site Care Period	Loss of Containment-Lateral Migration of CO_2 Outside Defined AoR:The CO_2 plume moves faster or in an unexpected pattern and expands beyond the secured pore space for the project and the AoR.	• Pulsed-neutron logs in observation wells • Pressure gauges real time in observation wells	• Detailed geologic model with stratigraphic wells as calibration • Seismic survey integrated in the model • Extensive characterization of the rocks and formation • Periodic review of CO_2 and pressure plume within AoR every 5 years • Monitor the plume over PISC	**Injection period:** • Trigger Emergency Shutdown system • SCADA alarms notification to operations staff • If major emergency, call 911 • Notify 24-Hour Emergency Contact • Review monitoring data and trends and compare with the simulation. • Notify UIC Program Director, propose action plan and request to keep injection process while AoR is reviewed, if the data show that CO_2 will stay in the secured pore space • Perform logging in observation wells. • Conduct geophysical survey as required to evaluate AoR. • Recalibrate model and simulate new AoR • Assess if additional corrective actions are needed and if it's required to secure additional pore space • Assess if any remediation is needed, and discuss action plan with UIC Program Director • Present AoR review to UIC Program Director for approval and adjust monitoring plan **Post Injection Site Care Period:** • SCADA alarms notification to monitoring personnel • If major emergency, call 911 • Notify 24-Hour Emergency Contact • Review monitoring data and trends, compare with the simulation • Notify UIC Program Director and propose action plan • Conduct geophysical survey as required to evaluate AoR • Recalibrate model, and simulate new AoR • Assess if additional corrective actions are needed and if it's required to secure additional pore space •Assess if any remediation is needed, and discuss action plan with UIC Program Director	• Operations manager • Field superintendent • Geologist • Reservoir engineers • Project manager

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
21	Injection Period/Post Injection Site Care Period	Containment - Pressure Propagation:A "pressure front" that exceeds the minimum pressure necessary to cause fluid flow from the injection zone into a USDW through a hypothetical conduit (i.e., an artificial penetration that is perforated in both intervals).	• Pulsed-neutron logs • Pressure gauges on surface and downhole real time • USDW water monitoring • Flow rate monitoring • Incremental leakage modeling to validate a lack of potential for fluid movement into the USDW.	• Detailed geologic model with stratigraphic wells as calibration • Seismic survey integrated in the model • Extensive characterization of the rocks and formation • Periodic review of CO2 and pressure plume within AOR every 5 years • Monitor the plume until stabilization (min 10 years) • USDW covered as second barrier with surface casing and surface cement sheet • Cased hole logging program	**Injection period:** • Identification by monitoring staff • Notify 24-Hour Emergency Contact • Review monitoring data and trends and compare with the simulation • If endangerment to USDW is suspected follow shut down procedure. • Notify UIC Program Director and propose action plan and request to keep injection process while AoR is reviewed, if the data shows that the CO_2 will stay in the secured pore space • Perform logging in observation wells • Conduct geophysical survey as required to evaluate AoR • Recalibrate model and simulate new AoR • Assess if additional corrective actions are needed and if it's required to secure additional pore space • Assess if any remediation is needed, and discuss action plan with UIC Program Director • Present AoR review to UIC Program Director for approval and adjust monitoring plan **Post Injection Site Care Period**: • Identification by monitoring staff • Notify 24-Hour Emergency Contact • Review monitoring data and trends and compare with simulations • Notify UIC Program Director and propose action plan • Conduct geophysical survey as required to evaluate AoR • Recalibrate model, and simulate new AoR • Assess if additional corrective actions are needed and if it's required to secure additional pore space • Evaluate if there is a movement of CO_2 or brines to USDW. In the remote event that USDW is affected, discuss remediation options with the UIC Program Director	• Operations manager • Field superintendent • Monitoring staff • Geologist • Reservoir engineers • Project manager • Remediation contractors

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
22	Injection Period	External impact – UIC Well:During injection, the wellhead is hit by a massive object that causes major damage to the equipment. The well gets disconnected from the pipeline and from the shutoff system and leads to a loss of containment of CO_2 and brine.	• Pressure and flow sensors in real time • Field inspections	• Fence location and block direct access to the wellhead • Bollards and/or concrete barriers installed to protect installation • No populated area	• Trigger emergency isolation valves • SCADA notification to monitoring or operations staff • Follow protocol to shut down CO_2 delivery if the automatic shutoff device is not functional • If public safety is threatened, notify ODNR at 1-844-642-2551 within 30 minutes • If major emergency, call 911 • Designate an exclusion zone, and provide appropriate PPE for protection of onsite personnel • If there are injured personnel, call emergency team, and execute evacuation protocol • Notify 24-Hour Emergency Contact • Clear the location and secure the perimeter. If possible, install containment devices around the location. • Contact well control special team to execute blowout emergency plan that may include but is not limited to capping the well, secure location, drill relief well to kill injector, properly repair or abandon injection well. This plan would be discussed with UIC Program Director • Evaluate environmental impact (soil, water, fauna, vegetation)• Notify UIC Program Director and propose action plan • Execute remediation, and install monitoring system as needed	• Operations manager • Field superintendent • Project manager • Rig crew and DH contractors • Remediation contractors • Well control specialist

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
23	Injection Period/ Post Injection Site Care Period	External impact – Monitoring Well Wellbores: The wellhead of the deep monitoring well is hit by a massive object that causes major damage leading to a LOC. Since the well is open to the formation pressure at the injection zone, formation fluids have the potential to flow and spill on the location.	• Pressure and flow sensors in real time • Field inspections • Incremental leakage modeling to validate a lack of potential for fluid movement into the USDW.	• Fence location and block direct access to the wellhead • Bollards and/or concrete barriers installed to protect installation • No populated area • Lined pads • Reduced pressure in the monitoring well compared with the injector well on bottom	• SCADA alarms notification to operations staff • If major emergency, call 911 • Designate an exclusion zone, and provide appropriate PPE for protection of onsite personnel • If there are injured personnel, call emergency team, and execute evacuation protocol • Notify 24-Hour Emergency Contact • Clear the location and secure the perimeter. If possible, install containment devices around the location. • Contact well control special team to execute blowout emergency plan that may include, but is not limited to, capping the well, securing the location, drilling relief well to kill the injector, properly repairing, or abandoning the injection well. • Evaluate environmental impact (soil, water, fauna, vegetation) • Notify UIC Program Director and propose action plan • Execute remediation, and install monitoring system as needed	• Operations manager • Field superintendent • Project manager • Rig crew and DH contractors • Remediation contractors • Well control specialist

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
24	Injection Period	External impact – Pipeline:During injection, the CO_2 pipeline is hit causing major damage and LOC of the CO_2.	• Pressure and flowmeter sensors in real time • Field inspections • Bollards and/or concrete barriers installed to protect aboveground piping at valve stations • Appropriate warning signage/painting • Appropriate fencing	• Buried pipe • Bollards and/or concrete barriers installed to protect aboveground piping at valve stations • Painting for visibility in varied weather conditions • Signage along right of way as needed • Pipeline is member of Ohio Utilities Protections Services' Ohio811	• Trigger emergency isolation valves • SCADA alarms notification to operations staff • If public safety is threatened, notify ODNR at 1-844-642-2551 within 30 minutes • If major emergency, call 911 • If there are injured personnel, call emergency team, and execute evacuation protocol • Designate an exclusion zone, and provide appropriate PPE for protection of onsite personnel • Verify CO_2 flow was shut off by the system or start protocol to stop flow • Notify 24-Hour Emergency Contact • Clear the location and secure the perimeter. If possible, install containment devices around the location • Evaluate environmental impact (soil, water, fauna, vegetation) • Notify UIC Program Director and propose action plan • Execute remediation, and install monitoring system as needed	• Operations manager • Field superintendent • Remediation contractors • Emergency teams • Plant manager/contact
25	Injection Period	Monitoring Equipment Failure or Malfunction: Failure of the monitoring system/ alarm devices that lead to over pressurization of the system or reservoir beyond the design limits, causing fracturing of the reservoir, leaks or failure on equipment and tubulars, and damage of the facilities.	• Real-time pressure monitoring system and redundancy • Field inspections	• Preventive maintenance • Periodic inspections	• Trigger emergency isolation valves • SCADA alarms notification to operations staff • Follow protocol to shut down CO_2 delivery if the automatic shutoff device is not functional • If major emergency, call 911 • If there are injured personnel, call emergency team, and execute evacuation protocol • Designate an exclusion zone, and provide appropriate PPE for protection of onsite personnel • Notify 24-Hour Emergency Contact • Assess mechanical integrity of the system, and propose repair actions if needed • Assess any potential environmental impact • Notify UIC Program Director and propose action plan • Repair or replace instrumentation. Calibrate equipment. • Review monitoring records, and if	• Operations manager • Field superintendent • Project manager • Remediation contractors • Emergency teams • Geologist • Reservoir engineers • Monitoring staff

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
					needed, perform an injectivity test or falloff test to evaluate reservoir	
26	Injection Period/ Post Injection Site Care Period	Injection or Monitoring Equipment Failure: Failure of surface injection or monitoring equipment including injection pumps, valves, gauges, meters, sensors, electrical, or other equipment results in potentially unsafe operating conditions and requires an emergency response at the site.	• Real-time monitoring system and redundancy • Field inspections • Routine inspection/testing of emergency alert systems, monitoring systems and controls systems	• Preventive maintenance • Periodic inspections	• Trigger emergency isolation valves • SCADA alarms notification to operations staff • Follow protocol to shut down CO_2 delivery if the automatic shutoff device is not functional • If major emergency, call 911 • If there are injured personnel, call emergency team, and execute evacuation protocol • Designate an exclusion zone, and provide appropriate PPE for protection of onsite personnel • Notify 24-Hour Emergency Contact • Assess mechanical integrity of the system, and propose repair actions if needed • Assess any potential environmental impact • Notify UIC Program Director and propose action plan • Perform Lockout/Tagout (LOTO) for defective equipment until it is properly replaced • Repair or replace instrumentation. Calibrate equipment. • If the assessment allows resuming injection safely, discuss plan with the UIC Program Director and get approval	• Operations manager • Field superintendent • Project manager • Remediation contractors • Emergency teams • Geologist • Reservoir engineers • Monitoring staff

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
27	Injection Period/ Post Injection Site Care Period	Injection or Monitoring Equipment Failure:Malfunction of subsurface injection/monitoring well subsurface equipment including gauges, fiber, cables, or capillary string, requiring an emergency response at the site.	• Real-time monitoring system and redundancy • Field inspections • Routine inspection/testing of emergency alert systems, monitoring systems and controls systems.	• Preventive maintenance • Periodic inspections	• SCADA alarms notification to operations staff • If major emergency, call 911 • If there are injured personnel, call emergency team, and execute evacuation protocol • Notify 24-Hour Emergency Contact • Assess mechanical integrity of the system, and propose repair actions if needed • Assess any potential environmental impact • Notify UIC Program Director and propose action plan • If the assessment allows resuming injection safely, discuss plan with the UIC Program Director and get approval • Repair or replace instrumentation. Calibrate equipment. • Review monitoring records, and if needed, perform an injectivity test or falloff test to evaluate reservoir	• Operations manager • Field superintendent • Project manager • Remediation contractors • Emergency teams • Geologist • Reservoir engineers • Monitoring staff
28	Injection Period	Injection or Monitoring Equipment Failure: A large pressure drop in the CO_2 stream results in low temperatures that could cause harm to personnel or damage/brittleness in materials (e.g., carbon steel and elastomers).	• Real time monitoring system of the CO_2 injection stream	• Use of materials that are rated for low temperatures • Controlled CO_2 stream composition	• Trigger emergency isolation valves • SCADA alarms notification to operations staff • Follow protocol to shut down CO2 delivery if the automatic shutoff device is not functional • If major emergency, call 911 • If there are injured personnel, call emergency team, and execute evacuation protocol • Designate an exclusion zone, and provide appropriate PPE for protection of onsite personnel • Notify 24-Hour Emergency Contact • Assess mechanical integrity of the system, and propose repair actions if needed • Assess any potential environmental impact, and propose remedial action with the UIC Program Director, if needed • If the assessment allows resuming injection safely, discuss plan with the UIC Program Director and obtain approval • Repair or replace any damaged equipment and recalibrate • Review monitoring records and, if needed, adjust CO_2 accordingly	• Operations manager • Field superintendent • Plant manager • Emergency teams

Number	Project Phase	Risk Scenario	Monitoring Equipment	Control In Place	Response Action	Response Personnel
29	Construction/ Injection Period/ Post Injection Site Care Period	Other Major Natural Disaster: Natural disaster that limits or endangers the normal operation of the Hub.	• Weather monitoring	• Project safety program • Condition/atmospheric monitoring. • Emergency shutdown valves	• SCADA alarms notification to operations staff • If major emergency, call 911 • If there is injured personnel or property damage, call emergency team, and execute evacuation protocol and secure location • Follow protocol to stop injection • Notify 24-Hour Emergency Contact • Assess mechanical integrity of the system • Assess any potential environmental impact • Notify UIC Program Director and propose repair actions based on findings • If the assessment allows resuming injection safely, increase surveillance to validate effectiveness of the actions	• Operations manager • Field superintendent • Project manager • Remediation contractors • Emergency teams • Geologist • Reservoir engineers • Monitoring staff
30	Injection Period	Accidents or Unplanned Event:Loss of electricity causing injection to cease.	• Field inspections	• PLC with Uninterrupted Power Supply (UPS) • "Fail-Closed" shutdown valves • Consider back feed to redundant generation sources or generation sources • Install industry standard weather mitigation on distribution lines • Solar Back-up if required	• SCADA alarms notification to operations staff • PLC/UPS programmed to initiate a closure of shutdown valves in fail safe position (Fail-Closed) • PLC/UPS will continue to monitor the shutdown and report back to the SCADA system for personnel • If major emergency, call 911 • If necessary, designate an exclusion zone, and provide appropriate PPE for protection of onsite personnel • Verify CO2 flow was shut off by the system or start manual protocol to stop flow, visual inspection, and manually close valves. • Notify 24-Hour Emergency Contact • Notify UIC Program Director within 24-hours of shut-in • Notify UIC Program Director of start-up procedure.	• Operations manager • Field superintendent • Project manager
31	Post-injection period	Unauthorized access/activity: Unauthorized activity on field site	• Field personnel logs	• Fencing around well sites • Security in place	• Notify 24-Hour Emergency Contact • Report any incidents to local Sheriff's office	• Field superintendent • Company man

Appendix B: Emergency Contact List

Tri-State CCS Buckeye 1, Carroll County, Ohio
Updated 1/30/25

Facility Contacts	Phone Number
24-Hour Emergency Contact During Construction: Project Manager – Claimed as PBI	Claimed as PBI
24-Hour Emergency Contact During Operation and Post-Injection: Operations Manager	TBD
Environmental Services Contractor	TBD
Local Agencies	
EMERGENCY – Local Emergency Responders	911
Carroll County Office of Emergency Management	330-627-0003
Carroll County Sheriff	330-627-2141
Carrollton Village Fire Department	330-627-2889
Fox Township Volunteer Fire Department	330-738-3086
State Agencies	
ODNR One-Call Incident Notification	844-642-2551
Ohio Emergency Management Division (24-Hour)	614-889-7150
Ohio Geological Survey	614-265-6576
Federal Agencies	
U.S. EPA Region 5 UIC Program Director (OH) – Kayla Schmalle	312-353-3944
National Response Center (24 hours)	800-424-8802