9. Testing and Monitoring Plan

This Testing and Monitoring Plan describes how ADM will monitor the CCS#3 site pursuant to 40 CFR 146.90. In addition to demonstrating that the well is operating as planned, the carbon dioxide plume and pressure front are moving as predicted, and that there is no endangerment to USDWs, the testing and monitoring data will be used to validate and adjust the geological models used to predict the distribution of the CO2 within the storage zone to support AoR reevaluations and a non-endangerment demonstration to support closure.

9.1 CO_2 stream analysis

ADM will analyze the CO2 stream during the operation period to yield data representative of its chemical and physical characteristics and to meet the requirements of 40 CFR 146.90(a).

Sampling will take place each calendar quarter.

ADM will analyze each CO_2 gas stream for the constituents identified in Table 9.1-1 using the methods listed.

Table 9.1-1. Summary of analytical parameters for CO2 gas streams.

Parameters	Analytical Methods (1)
Oxygen	ISBT 4.0 (GC/DID) GC/TCD
Nitrogen	ISBT 4.0 GC/DID GC/TCD
Carbon Monoxide	ISBT 5.0 Colorimetric ISBT 4.0 (GC/DID)
Oxides of Nitrogen	ISBT 7.0 Colorimetric
Total Hydrocarbons	ISBT 10.0 THA (FID)
Methane	ISBT 10.1 GC/FID)
Acetaldehyde	ISBT 11.0 (GC/FID)
Sulfur Dioxide	ISBT 14.0 (GC/SCD)
Hydrogen Sulfide	ISBT 14.0 (GC/SCD)
Ethanol	ISBT 11.0 (GC/FID)
Carbon Dioxide	ISBT 2.0 Caustic absorption Zahm-Nagel ALI method SAM 4.1 subtraction method (GC/DID) GC/TCD

9.1.1 Sampling Methods

CO_2 stream sampling will occur in the compressor building after the last stage of compression and prior to flowline conveyance to the injection wellhead. A sampling station will be installed with the ability to purge and collect samples into a container that will be sealed and sent to the authorized laboratory.

All sample containers will be labeled with durable labels and indelible markings. A unique sample identification number and sampling date will be recorded on the sample containers.

9.1.2 Laboratory to be Used/Chain of Custody Procedures

Samples will be analyzed by a third party laboratory using standardized procedures for gas chromatography, mass spectrometry, detector tubes, and photo ionization. The sample chain-of- custody procedures described in Section B.3 of the QASP will be employed.

9.2 Mechanical integrity and corrosion testing

To meet the requirements of 40 CFR 146.90(c), ADM will monitor well materials during the operation period for loss of mass, thickness, cracking, pitting, and other signs of corrosion at surface to ensure that the well components meet the minimum standards for material strength and performance.

This monitoring will occur once per calendar quarter.

ADM will monitor corrosion using the corrosion coupon method and collect samples according to the description below.

9.2.1 Sample Description

Samples of material used in the construction of the compression equipment, pipeline and injection well which come into contact with the CO_2 stream will be included in the corrosion monitoring program either by using actual material and/or conventional corrosion coupons. The samples consist of those items listed in Table 9.2.1-1 below. Each coupon will be weighed, measured, and photographed prior to initial exposure (see "Sample Handling and Monitoring" below).

Table 9.2.1-1. List of Equipment Coupon with Material of Construction.

Equipment Coupon	Material of Construction
Pipeline	Sensitive, Confidential, or Privileged Information [redacted]
Long String Casing (Surface - 4,800')	
Long String Casing (4,800' – TD)	
Injection Tubing	
Wellhead	

Packers 1	Chrome alloy

9.2.2 Sample Exposure

Each sample will be attached to an individual holder (Figure 2a) and then inserted in a flow- through pipe arrangement (Figure 2b). The corrosion monitoring system will be located downstream of all process compression/dehydration/pumping equipment (i.e., at the beginning of the pipeline to the wellhead). To accomplish this, a parallel stream of high pressure CO_2 will be routed from the pipeline through the corrosion monitoring system and then back into a lower pressure point upstream in the compression system. This loop will operate any time injection is occurring. No other equipment will act on the CO_2 past this point; therefore this location will provide sufficiently representative exposures of the samples to the CO_2 composition, temperature, and pressures that will be seen at the wellhead and injection tubing. The holders and location of the system will be included in the pipeline design and will allow for continuation of injection during sample removal.

Figure 2a. Coupon Holder.

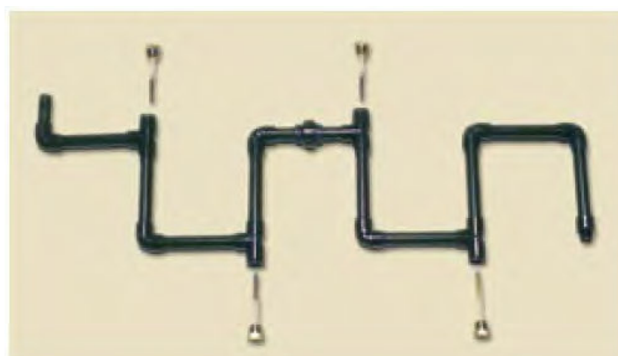

Figure 2b. Flow-through Pipe Arrangement.

9.2.3 Sample Handling and Monitoring

The coupons will be handled and assessed for corrosion using the American Society for Testing and Materials (ASTM) G1-03, Standard Practice for Preparing, Cleaning, and Evaluating Corrosion Test Specimens (ASTM 2011). The coupons will photographed, visually inspected with a minimum of 10x power, dimensionally measured (to within 0.0001 inch), and weighed (to within 0.0001 gm).

9.3 Pressure fall-off testing

ADM will perform pressure fall-off tests during the injection phase as described below to meet the requirements of 40 CFR 146.90(f).

At a minimum, pressure fall-off testing will be performed:

- During injection in year 5 of operation; and
- At least every 5 years during the remainder of the injection period.

ADM will conduct pressure fall-off testing according to the procedures below.

9.3.1 Pressure Fall-off Test Procedure

Each pressure falloff test will include a period of injection followed by a period of no-injection or shut-in. Normal injection using the stream of CO_2 captured from the ADM facility will be used during the injection period preceding the shut-in portion of the falloff tests. The normal injection rate is estimated to be maximum 3,300 MT/day. Prior to the falloff test, a constant rate will be maintained. If this rate causes relatively large changes in bottomhole pressure, the rate may be decreased. Injection will have occurred for multiple years prior to this test, but there may have been injection interruptions due to operations or testing. At a minimum, one week of relatively continuous injection will precede the shut-in portion of the falloff test; however, several months of injection prior to the falloff will likely be part of the pre- shut-in injection period and subsequent analysis. This data will be measured using a surface readout downhole gauge so a final decision on test duration can be made after preliminary evaluation of the data takes place. The gauges may be those used for day-to-day data acquisition or a pressure gauge will be conveyed via electric line (e-line).

To reduce the wellbore storage effects attributable to the pipeline and surface equipment, the well will be shut-in at the wellhead nearly instantaneously with direct coordination with the injection compression facility operator. Because surface readout will be used and downhole recording memory restrictions will be eliminated, data will be collected at five second intervals or more frequently for the entire test. The shut-in period of the falloff test will be at least four days or longer until adequate pressure transient data are collected to allow meaningful interpretation of the data. Because surface readout gauges will be used, the shut-in duration can be determined in real-time. A report containing the pressure falloff data and interpretation of the reservoir ambient pressure will be submitted to the permitting agency within 90 days of the test. Pressure sensors used for this test will be the wellhead sensors and a downhole gauge for the pressure falloff test. Each gauge will be of a type that meets or exceeds ASME B 40.1 Class 2A (0.5% accuracy across full range). Wellhead pressure gauge range will be 0-4,000 psi. Downhole gauge range will be 0-10,000 psi.

9.4 Groundwater quality monitoring

The purpose of the groundwater monitoring plan is to evaluate potential carbon dioxide (CO2) migration and/or native fluid displacement from the injection zone or other water quality changes that may lead to endangerment of USDWs. ADM will monitor three separate zones during operation to meet the requirements of 40 CFR 146.90(d).

9.4.1 Identification of Monitored Intervals

The groundwater monitoring plan focuses on the following zones:

[redacted]

ADM currently operates four shallow monitoring wells, two geophysical monitoring wells, and two verification wells. These wells were included in the approved testing and monitoring program submitted previously for CCS#2. [redacted] ADM will also install a third verification (VM) well to monitor the zone directly above the confining zone. All of the existing and proposed monitoring locations are located on ADM property.

Table 9.4.2-1 and Table 9.4.3-1 show the planned direct and indirect monitoring methods, locations, and frequencies for groundwater quality monitoring above the confining zone. ADM will also monitor in the Mt. Simon Sandstone (the injection zone). Monitoring in this layer will be to track the CO_2 plume and is described in Section 9.5.

9.4.2 Direct Monitoring Methods

ADM will employ direct monitoring methods such as pressure and temperature monitoring and fluid sampling on a monthly or annual basis. Table 9.4.2-1 summarizes the planned locations and frequencies of all applicable direct monitoring methods.

Table 9.4.2-1. Summary of Direct Monitoring Methods

Target Formation	Monitoring Activity	Monitoring Location(s)	Spatial Coverage	Frequency
Quaternary and/or Pennsylvanian Strata	Fluid Sampling	Sensitive, Confidential, or Privileged Information [redacted]		Baseline; Quarterly during Year 1 & 2; Semi-annual thereafter
	Temperature Monitoring (DTS)			Continuous**; recorded hourly
				Continuous**; recorded hourly
				Continuous**; recorded hourly
St. Peter	Fluid Sampling			Baseline; Annual
				Baseline; Annual
				Baseline; Annual
	Pressure Monitoring			Monthly
				Monthly
				Monthly
	Temperature Monitoring (DTS)			Continuous**; recorded hourly
				Continuous**; recorded hourly
				Continuous**; recorded hourly
Ironton-Galesville	Pressure Monitoring			Monthly
				Monthly
				Monthly
	Temperature Monitoring (DTS)			Continuous**; recorded hourly
				Continuous**; recorded hourly
				Continuous**; recorded hourly
				Baseline; Annual

Target Formation	Monitoring Activity	Monitoring Location(s)	Spatial Coverage	Frequency
	Fluid Sampling	Sensitive, Confidential, or Privileged Information [redacted]		Baseline; Annual
				Baseline; Annual

Notes:

* indicates applicable if the proposed well is drilled in the future. Sample location estimated based off offset information, subject to change after drilling.

**Continuous temperature and pressure monitoring (DTS) will be satisfied with a minimum 5 minute sampling and at least hourly recording. If the continuous monitoring is unavailable, the well can continue to operate by performing pressure and temperature monitoring every 4 hours.

9.4.3 Indirect Monitoring Methods

ADM will continue to employ indirect monitoring methods such as wireline logging and seismic monitoring. Table 9.4.3-1 summarizes the planned locations and frequencies of all applicable indirect monitoring methods.

Table 9.4.3-1. Summary of Indirect Monitoring Methods

Target Formation	Monitoring Activity	Monitoring Location(s)	Spatial Coverage	Frequency
Quaternary and/or Pennsylvanian Strata	Pulse Neutron/RST Logging	Sensitive, Confidential, or Privileged Information [redacted]		Baseline, Bi-Annual
				Baseline, Bi-Annual
				Baseline, Bi-Annual
				Baseline, Bi-Annual
				Baseline, Bi-Annual
				Baseline, Bi-Annual
St. Peter	Pulse Neutron/RST Logging			Baseline, Bi-Annual
				Baseline, Bi-Annual
				Baseline, Bi-Annual
				Baseline, Bi-Annual
				Baseline, Bi-Annual
				Baseline, Bi-Annual
Ironton-Galesville				Baseline, Bi-Annual
				Baseline, Bi-Annual

Target Formation	Monitoring Activity	Monitoring Location(s)	Spatial Coverage	Frequency
	Pulse Neutron/RST Logging	Sensitive, Confidential, or Privileged Information [redacted]		Baseline, Bi-Annual
				Baseline, Bi-Annual
				Baseline, Bi-Annual
				Baseline, Bi-Annual
	Passive seismic			Continuous**; processed monthly
	Time-lapse 3D surface seismic			5-Year

Notes:

* indicates applicable if the proposed well is drilled in the future

**Continuous recording of passive seismic data is processed on a monthly basis to determine if seismic events over M1.0 occurred within the AoR. The passive seismic monitoring system at borehole and surface seismic stations is owned and operated by USGS.

9.4.4 Analytical and Field Parameters for Groundwater Samples

Sampling will be performed as described in Section B.2 of the Quality Assurance Sampling Plan (QASP); this section of the QASP describes the groundwater sampling methods to be employed, including sampling SOPs (Section B.2.a/b), and sample preservation (Section B.2.g). Sample handling and custody will be performed as described in Section B.3 of the QASP. Quality control will be ensured using the methods described in Section B.5 of the QASP.

Table 9.4.4-1. Summary of Fluid Sampling Constituents and Analytical Methods

Target Formation	Parameters	Analytical Methods [1]
Quaternary/Pennsylvanian	**Cations:** Ca, Fe, K, Mg, Na, and Si	ICP-OES, EPA Method 6010B
	Anions: Br, Cl, F, NO3, and SO4	Ion Chromatography, EPA Method 300.0
	Dissolved CO_2	Coulometric titration, ASTM D513-11
	Total Dissolved Solids	Gravimetry; APHA 2540C
	Alkalinity	APHA 2320B
	pH (field)	EPA 150.1
	Specific conductance (field)	APHA 2510
	Temperature (field)	Thermocouple
St. Peter	**Cations:** Ca, Fe, K, Mg, Na, and Si	ICP-OES, EPA Method 6010B
	Anions: Br, Cl, F, NO3, and SO4	Ion Chromatography, EPA Method 300.0
	Dissolved CO2	Coulometric titration, ASTM D513-11
	Isotopes: δ13C of DIC	Isotope ratio mass spectrometry
	Total Dissolved Solids	Gravimetry; APHA 2540C
	Water Density (field)	Oscillating body method
	Alkalinity	APHA 2320B
	pH (field)	EPA 150.1
	Specific conductance (field)	APHA 2510
	Temperature (field)	Thermocouple
Ironton-Galesville	**Cations:** Ca, Fe, K, Mg, Na, and Si	ICP-OES, EPA Method 6010B
	Anions: Br, Cl, F, NO3, and SO4	Ion Chromatography, EPA Method 300.0
	Dissolved CO2	Coulometric titration, ASTM D513-11
	Isotopes: δ13C of DIC	Isotope ratio mass spectrometry
	Total Dissolved Solids	Gravimetry; APHA 2540C
	Water Density (field)	Oscillating body method
	Alkalinity	APHA 2320B
	pH (field)	EPA 150.1

Target Formation	Parameters	Analytical Methods [1]
	Specific conductance (field)	APHA 2510
	Temperature (field)	Thermocouple

Note 1: ICP = inductively coupled plasma; MS = mass spectrometry; OES = optical emission spectrometry; GC-P = gas chromatography - pyrolysis. An equivalent method may be employed with the prior approval of the UIC Program Director.

9.5 CO_2 plume and pressure front tracking

9.5.1 Direct Monitoring Methods

<u>Monitoring of Temperature and Pressure</u>

In-situ pressure measurements will be recorded in all active injection wells. Pressure data will be collected via downhole pressure gauges located near the base of the Eau Claire Formation (the confining zone) in addition to the Ironton-Galesville Sandstone located directly above the Eau Claire formation. Temperature will be monitored in all active injection wells throughout each wellbore. This monitoring well be conducted for as long as remains practical utilizing a fiber-optic, dynamic temperature survey (DTS) to be installed during the installation of each well.

Significant variance between actual measured and predicted pressure/temperature (P/T) data will indicate that a re-calibration of the numerical model is warranted. Review and revisions to the model and subsequently the area of review (AoR) and the monitoring program supported by simulations generated with the model will be conducted on a minimum frequency of once every 5-years during operations to incorporate any subsequent changes in model predictions.

<u>Addition of Verification Well #3 (VW #3)</u>

The approved testing and monitoring program submitted in 2017 incorporated two verification wells (VW#1 and VW #2) to monitor plume front and associated pressures as a result of injection into CCS#1 and CCS#2. The proposed VW#3 is located south of all three CCS locations.

The addition of CCS#3 and the use of the existing two site wells (CCS#1 and CCS#2) for continued injection service will increase the volume of CO_2 injection introduced into the injection zone and will extend both the area over which pressure rise and CO_2 saturation will occur within the injection zone. Pressure will be impacted by cumulative operation of all wells completed in the same injection interval. These effects will increase the size of the existing AoR and the altered distribution of fluids, and one verification well will be added appropriate for confirmatory monitoring. Figure 9.5.1-1 presents the current and proposed configuration of the well development at the site and Figure 9.5.1-2 shows the wells superimposed on a satellite image for reference. Figure 9.5.1-3 is an enhanced view showing the potential location for VW#3. The optimal VW#3 location was selected based on the regulatory guidelines described above.

1) With regard to down-gradient orientation, current modeling indicates that the down-gradient gravity effects are not significant enough to meaningfully influence plume drift during the operational period (Figure 9.5.1-4 presents the extent of the CO_2 plume growth at specified time horizons). Based on these modeling predictions, direct monitoring in VW #2, in addition to indirect seismic methods, are projected to be sufficient for tracking potential plume migration to the north and providing useful data for future model comparison and calibration.

2) Based on Figure 9.5.1-4, the CO_2 plume is predicted to eclipse the new VW #3 location during the operational period. Pressure impacts will be able to be measured earlier than probable arrival time of concentration changes that will occur later in the life of the operation. These changes will be influenced by allocation between injectors and total volume actually injected into the well system. A more substantial distance from offset injectors to the VW #3 location as compared with the offset between prior injector-verification well pairs will allow for more elapsed time to pass before higher concentration CO_2 is projected to encounter the location. Tuning the model to the closer offset existing well pairs and to these data will enhance the ability to verify that larger-scale and longer-term model projections are meaningful. In addition to pressure monitoring in an area closer to proposed future injector locations than the existing VW- 1 and VW#2, fluid samples taken in the Mt Simon at VW-3 will provide an additional means to validate modeled CO_2 concentration vs. distance in another direction that will be impacted by the altered distribution of injectate based on the addition of injection locations.

3) The current orientation of VW #1 and VW #2 allow for direct monitoring to the immediate north of the injection centroid. From an aerial perspective, plume migration and associated pressure rise that develop to the south cannot be as effectively evaluated from the existing 2-well monitoring array. The addition of VW #3 will enhance the ability to characterize fluid and pressure migration in the injection zone by allowing acquisition of data in an opposite azimuth relative to the existing verification wells.

Figures 9.5.1-4 and 9.5.1-5 illustrate model projections of pressure and plume front relative to the VW #3 location. As shown in these figures, the selected VW #3 location provides a useful additional monitoring location that will generate data later in the progression of the plume and pressure front development than VW #1 and 2. VW #1 is in a location such that it provided valuable data regarding the behavior of the reservoir close to the original completion layer in VW #1 and can be re-used to provide confirmation of behavior close to CCS#1 due to injection into any recompletion of CCS#1. In addition to satisfying the general regulatory guidelines and technical objectives, the selected location of VW #3 offers suitable surface access for drilling, testing and future maintenance/workover operations. The three-well VW network is sufficient to provide spatial and temporal resolution of plume and pressure development within the multi-well CCS system to be operated at the ADM site.

VW #3 installation will take place with or after installation of the next injector at the site. Additional CCS wells are not anticipated to trigger the need for further VW well installation; monitoring of site pressure and plume development will be accomplished through monitoring with the distributed three-well VW system in addition to the monitoring of each active injector.

Sensitive, Confidential, or Privileged Information

[redacted]

Figure 9.5.1-1. Orientation of ADM Injection and Monitoring Wells (Coordinate View)

Sensitive, Confidential, or Privileged Information

[redacted]

Figure 9.5.1-2. Orientation of ADM Injection and Monitoring Wells (Surface View)

Sensitive, Confidential, or Privileged Information

[redacted]

Figure 9.5.1-3. Planned Surface Location of Verification Well #3

Sensitive, Confidential, or Privileged Information

[redacted]

Figure 9.5.1-4. Verification Well #3 Proximity to Projected Plume Arrival

Sensitive, Confidential, or Privileged Information

[redacted]

Figure 9.5.1-5. Verification Well #3 Proximity to AOR Boundary

Annual Fluid Sampling

Following baseline fluid sampling and analysis, fluid sampling will be conducted on an annual basis in all monitoring-verification wells. Initial samples will be taken via packer-isolated sliding sleeves located adjacent to the Ironton-Galesville Sandstone or suitable equivalent method if complications are encountered with the equipment and within the Mt. Simon Formation below the lower-most packer. Each sample interval will be analyzed for the constituents listed in Table 9.5.2-1 to document baseline fluid chemistry and to detect changes in fluid chemistry that could result from the movement of brine or CO_2 from the storage interval through the overlying confining zone and other formation.

Table 9.5.2-1. Summary of Fluid Sampling Constituents and Analytical Methods

Parameters	Analytical Methods [1]
Cations: Ca, Fe, K, Mg, Na, and Si	ICP-OES, EPA Method 6010B
Anions: Br, Cl, F, NO3, and SO4	Ion Chromatography, EPA Method 300.0
Dissolved CO2	Coulometric titration, ASTM D513-11
Isotopes: δ13C of DIC	Isotope ratio mass spectrometry
Total Dissolved Solids	Gravimetry; APHA 2540C
Water Density (field)	Oscillating body method
Alkalinity	APHA 2320B
pH (field)	EPA 150.1
Specific conductance (field)	APHA 2510
Temperature (field)	Thermocouple

By conducting the planned sampling initially and at specified monitoring frequencies, it is expected that baseline conditions can be documented, natural variability in conditions can be characterized, and unintended brine or CO_2 migration could be detected if it occurred. Sufficient data will be collected to demonstrate that the effects of CO_2 injection are limited to the permitted injection zone comprised of the Mt. Simon formation. Table 9.5.2-2 summarizes the planned locations and frequencies of all applicable direct monitoring methods.

Table 9.5.2-2. Summary of Direct Monitoring Methods

Target Formation	Monitoring Activity	Monitoring Location(s)	Spatial Coverage	Frequency
Ironton-Galesville	Pressure Monitoring	Sensitive, Confidential, or Privileged Information [redacted]	[redacted]	Monthly
		[redacted]	[redacted]	Monthly
		[redacted]	[redacted]	Monthly
	Temperature Monitoring (DTS)	[redacted]	[redacted]	Continuous**; recorded hourly
		[redacted]	[redacted]	Continuous**; recorded hourly
		[redacted]	[redacted]	Continuous**; recorded hourly
	Fluid Sampling	[redacted]	[redacted]	Baseline; Annual
		[redacted]	[redacted]	Baseline; Annual
		[redacted]	[redacted]	Baseline; Annual

Target Formation	Monitoring Activity	Monitoring Location(s)	Spatial Coverage	Frequency
Mt. Simon	Pressure Monitoring	Sensitive, Confidential, or Privileged Information [redacted]	[redacted]	Continuous**; recorded hourly
		[redacted]	[redacted]	Continuous**; recorded hourly
		[redacted]	[redacted]	Continuous**; recorded hourly
		[redacted]	[redacted]	Monthly
		[redacted]	[redacted]	Monthly
		[redacted]	[redacted]	Monthly
	Temperature Monitoring (DTS)	[redacted]	[redacted]	Continuous**; recorded hourly
		[redacted]	[redacted]	Continuous**; recorded hourly
		[redacted]	[redacted]	Continuous**; recorded hourly
		[redacted]	[redacted]	Baseline; Annual

Sensitive, Confidential, or Privileged Information

	Fluid Sampling	[redacted]	Baseline; Annual
			Baseline; Annual

Note:

* indicates applicable if the proposed well is drilled in the future

**Continuous temperature and pressure monitoring (DTS) will be satisfied with a minimum 5 minute sampling and at least hourly recording. If the continuous monitoring is unavailable, the well can continue to operate by performing pressure and temperature monitoring every 4 hours.

9.5.2 Indirect Monitoring Methods

Wireline Logging

Both pulse-neutron and reservoir-saturation logs will be conducted initially and once every two years in all active injection and verification wells. Baseline conditions will be established in any new wells drilled by conducting initial logging as part of new well completions. At a minimum, initial logging will be conducted from surface to TD and subsequent logging will be conducted over intervals sufficient to establish changing conditions. Analysis of logging data will provide a means to complement and verify the results obtained from the fluid sampling program, specifically regarding any potential migration of CO_2 into and/or above the confining zone.

Seismic Monitoring

Time-lapse seismic surveys will be conducted at 5-year intervals during the operational period and used as a broad-scale means to attempt to track the migration of the subsurface CO_2 plume. Data collection has previously been conducted at the site outside any potential plume boundary. In the future, similar areas will be surveyed and the area expanded if reservoir modeling data and verification well monitoring indicate a need for expanded data acquisition to ascertain the leading edge of the plume. Analysis of subsequent seismic survey data will provide a supplemental method for assisting with validating the numerical model forecasts as they pertain to maximum plume extent and distribution. In addition, ADM will continue to operate its current passive-seismic monitoring system or a suitable equivalent replacement system, with the ability to detect seismic events exceeding M1.0 within the AOR. Table 9.5.2-1 summarizes the methods and locations of the planned indirect monitoring program.

Table 9.5.2-1. Summary of Indirect Monitoring Methods

Monitoring Activity	Monitoring Location(s)	Spatial Coverage	Frequency
Pulse Neutron/RST Logging	Sensitive, Confidential, or Privileged Information [redacted]		Baseline, Bi-Annual
			Baseline, Bi-Annual
			Baseline, Bi-Annual
			Baseline, Bi-Annual
			Baseline, Bi-Annual
			Baseline, Bi-Annual
Passive seismic			Continuous**; recorded monthly
Time-lapse 3D surface seismic			5-Year

Note: * indicates applicable if the proposed well is drilled in the future

**Continuous recording of passive seismic data is processed on a monthly basis to determine if seismic events over M1.0 occurred within the AoR. The passive seismic monitoring system at borehole and surface seismic stations is owned and operated by USGS.

9.6 Testing and monitoring plan QASP

A quality assurance and surveillance plan (QASP) for all testing and monitoring activities pursuant to 40 CFR 146.90(k) is provided in APPENDIX C: Quality Assurance and Surveillance Plan.

9.7 Reporting Requirements

The following details the reporting and recordkeeping requirements as it relates to CCS#3.

9.7.1 Electronic Reporting

Electronic reports, submittals, notifications and records made and maintained by the permittee under this permit will be in an electronic format approved by EPA. The permittee will electronically submit all required reports to the Director at the following website or via a suitable alternative method as may be instructed by EPA: *https://gsdt.pnnl.gov/*

9.7.2 Semi-Annual Reports

ADM will submit semi-annual reports containing:

(a) Any significant changes to the physical, chemical, and other relevant characteristics of the carbon dioxide stream from the proposed operating data;
(b) Monthly average, maximum, and minimum values for injection pressure, flow rate and daily volume, temperature, and annular pressure;
(c) A description of any event that exceeds operating parameters for annulus pressure or injection pressure specified in the permit;
(d) A description of any event which triggers the shut-off systems based on permit operational alarm value setpoints required pursuant to 40 CFR 146.88(e), and the response taken;
(e) The monthly volume and/or mass of the carbon dioxide stream injected over the reporting period and the volume and/or mass injected cumulatively over the life of the project;
(f) Monthly annulus fluid volume added or produced; and
(g) Results of the monitoring required in the Testing and Monitoring Plan, including:
    (i) A tabulation of: (1) daily maximum injection pressure, (2) daily minimum annulus pressure, (3) daily minimum value of the difference between simultaneous measurements of annulus and injection pressure, (4) daily volume, (5) daily maximum flow rate, and (6) average annulus tank fluid level; and
    (ii) Graph(s) of the monitoring as required, or of daily average values of these parameters. The injection pressure, injection volume and flow rate, annulus fluid level, annulus pressure, and temperature shall be submitted on one or more graphs, using contrasting symbols or colors, or in another manner approved by the Director; and
(h) Results of any additional monitoring identified in the Testing and Monitoring Plan.

9.7.3 24-Hour Reporting

ADM will report to the Director any permit noncompliance which may endanger human health or the environment and/or any events that require implementation of actions in the Emergency and Remedial Response Plan. Any information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. Such verbal reports shall include, but not be limited to the following information:

- Any evidence that the injected carbon dioxide stream or associated pressure front may cause an endangerment to a USDW, or any monitoring or other information which indicates that any contaminant may cause endangerment to a USDW;
- Any noncompliance with a permit condition, or malfunction of the injection system, which may cause fluid migration into or between USDWs;
- Any triggering of the shut-off system required (i.e., down-hole or at the surface);
- Any failure to maintain mechanical integrity;
- Pursuant to compliance with the requirement at 40 CFR 146.90(h) for surface air/soil gas monitoring or other monitoring technologies, if required by the Director, any release of carbon dioxide to the atmosphere or biosphere; and
- Actions taken to implement appropriate protocols outlined in the Emergency and Remedial Response Plan.

A written submission to document any required 24-hour reporting shall be provided to the Director in an electronic format within five days of the time the permittee becomes aware of the circumstances described in Section 9.7.3. The submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and, if the noncompliance has not been corrected, the anticipated time it is expected to continue as well as actions taken to implement appropriate protocols outlined in the Emergency and Remedial Response Plan; and steps taken or planned to reduce, eliminate and prevent recurrence of the noncompliance.

9.7.4 Reports on Well Tests and Workovers

Report, within 30 days, the results of:

- Periodic tests of mechanical integrity;
- Any well workover or stimulation;
- Any other test of the injection well conducted by the permittee if required by the Director; and
- Any test of any monitoring well required by this permit.

9.7.5 Advance Notice Reporting

- Well Tests – ADM will give at least 30 days advance written notice to the Director in an electronic format of any planned workover, stimulation, or other well test.
- Planned Changes – ADM will give written notice to the Director in an electronic format, as

soon as practical, of any planned physical alterations or additions to the permitted injection facility other than minor repair/replacement or maintenance activities. An analysis of any new injection fluid shall be submitted to the Director for review and written approval at least 30 days prior to injection; this approval may result in a permit modification.

- Anticipated Noncompliance – ADM will give advanced written notice to the Director in an electronic format of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

9.7.6 Additional Reports

- Compliance Schedules – Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit will be submitted in an electronic format by ADM no later than 30 days following each schedule date.
- Transfer of Permits – This permit is not transferable to any person except after notice is sent to the Director in an electronic format at least 30 days prior to transfer and the requirements of 40 CFR 144.38(a) have been met. Pursuant to requirements at 40 CFR 144.38(a), the Director will require modification or revocation and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under the SDWA.
- Other Noncompliance – ADM will report in an electronic format all other instances of noncompliance not otherwise reported with the next monitoring report. The reports shall contain the information listed in Section 9.7.3 above.
- Other Information – When ADM becomes aware of failure to submit any relevant facts in the permit application or that incorrect information was submitted in a permit application or in any report to the Director, ADM will submit such facts or corrected information in an electronic format within 10 days in accordance with 40 CFR 144.51(l)(8).
- Report on Permit Review – Within 30 days of receipt of this permit, ADM will certify to the Director in an electronic format that he or she has read and is personally familiar with all terms and conditions of this permit.

9.7.7 Records

ADM will retain records and all monitoring information, including all calibration and maintenance records and all original chart recordings for continuous monitoring instrumentation and copies of all reports required by this permit (including records from pre-injection, active injection, and post-injection phases) for a period ofat least 10 years from collection.

ADM will maintain records of all data required to complete the permit application form for this permit and any supplemental information (e.g. modeling inputs for AoR delineations and reevaluations, plan modifications) submitted under 40 CFR 144.27, 144.31, 144.39, and 144.41; information used to develop the demonstration of the alternative post-injection site care timeframe; and the site closure report for a period of at least 10 years after site closure.

ADM will retain records concerning the nature and composition of all injected fluids until 10 years after site closure.

Records of monitoring information shall include:

- The date, exact place, and time of sampling or measurements;
- The name(s) of the individual(s) who performed the sampling or measurements;
- A precise description of both sampling methodology and the handling of samples;

- The date(s) analyses were performed;
- The name(s) of the individual(s) who performed the analyses;
- The analytical techniques or methods used; and
- The results of such analyses.