US ERA ARCHIVE DOCUMENT

ATTACHMENT E: POST-INJECTION SITE CARE (PISC) AND SITE CLOSURE PLAN

Facility Information

Facility Name: FutureGen 2.0 Morgan County CO₂ Storage Site

IL-137-6A-0004 (Well #4)

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Location of Injection Well: Morgan County, IL; 26–16N–9W; 39.80111°N and 90.07544°W

This Post-Injection Site Care and Site Closure (PISC) plan describes the activities that the FutureGen Alliance will perform to meet the requirements of 40 CFR 146.93. The FutureGen Alliance will monitor ground water quality and track the position of the carbon dioxide plume and pressure front for fifty years of post-injection site care and may not cease post-injection monitoring and site care until a demonstration of non-endangerment of USDWs has been approved by the UIC Program Director pursuant to 40 CFR 146.93(b)(3). Following approval for site closure, the FutureGen Alliance will plug all monitoring wells, restore the site to its original condition, and submit a Site Closure report and associated documentation.

Pre- and Post-Injection Pressure Differential

The information regarding pre- and post-injection pressure differentials, as required by 40 CFR 146.93(a)(2)(i) is presented below.

The maximum injection pressure differential is 479 psi at the injection well when injection stops. The magnitude and area of elevated pressure gradually decreases over time after injection stops; as further detailed in Table 1.

Figure 1 shows the pressure differential versus time for monitoring well locations in the Area of Review (AoR) and at the geometric centroid of the four horizontal injection wells. Simulated pressures at the injection "point" increase during the 20-year injection period from 1,779 psi to a maximum of 2,258 psi. The highest pressures are in the immediate vicinity of each injection well. As shown, pressures at the injection and monitoring well locations decline over time after injection ceases. Despite the modeled pressure of 2,258 psi, current permit limitations will require the pressure in the injection well not to exceed 2,252 psi.

Figure 2 presents aqueous pressure differentials from baseline at the top of the injection zone and the extent of the carbon dioxide plume at 20 years after the start of injection (i.e., the end of injection) and 70 years after the start of injection (i.e., at site closure).

Table 1. Pressure differential to baseline conditions at well locations near the base of the Ironton Formation for Above Confining Zone Well 1 (ACZ1) and ACZ2 and at the middle of the Mount Simon 11 layer in the injection zone for the rest of the wells during and after.

Press	ure Differe	ntial (psi))		
Year	SLR1	SLR2	ACZ1	ACZ2	Injection Well
Distance from Injection Well (ft)	3740	6555	1010	3740	0
Elevation (ft)	-3371	-3414	-2763	-2751	-3390
0 (Start injection)	0	0	0	0	0
1	223	125	0	0	350
2	277	165	0	0	394
3	311	192	0	0	417
4	333	211	0	0	431
5	348	225	0	0	441
10	393	274	0	0	466
15	413	313	1	1	475
20 (Stop injection at year end)	425	338	2	2	479
21	255	235	2	2	259
22 (Approximate maximum extent of CO ₂	,				
Plume)	199	186	2	2	200
23	167	157	2	2	167
24	145	137	3	3	145
25	129	121	3	3	128
30	85	81	4	4	84
35	64	61	4	4	63
40	51	49	5	5	50
45	42	40	5	5	41
50	36	34	5	5	35
60	27	26	5	5	26
70	22	21	5	5	21
80	18	17	5	5	17
90	15	14	5	5	14
100	13	12	4	4	12
SLR	1 Single-	Level in-	-Reservoi	r #1	
SLR	2 Single-	Level in-	-Reservoi	r #2	
ACZ	1 Above	Confinin	g Zone#	1	
ACZ	2 Above	Confinin	g Zone#	2	
Injection We	ll Geome	tric centi	oid of fo	ur horizon	tal laterals

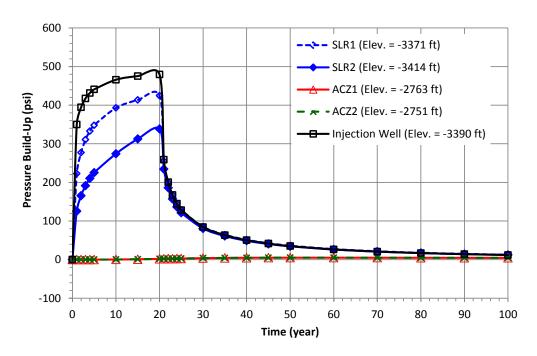


Figure 1. Simulated aqueous pressure differential versus time at monitoring well locations near the base of the Ironton Formation for ACZ1 and ACZ2 and at the middle of the Mount Simon 11 layer in the injection zone for the rest of the wells.

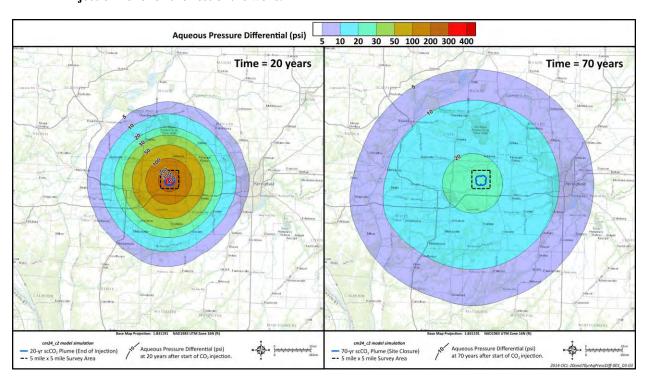


Figure 2. Aqueous pressure differentials from baseline condition at the top of the injection zone and CO₂ plume extents at 20 years (end of injection) and 70 years (site closure) after start of injection.

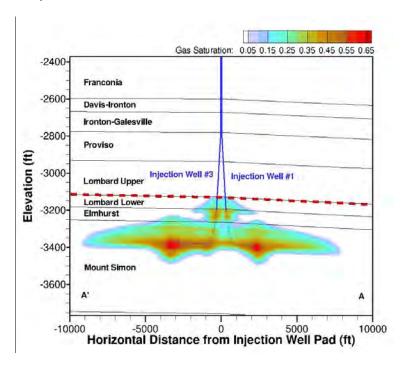
<u>Predicted Position of the CO₂ Plume and Associated Pressure Front Upon Cessation of Injection and at Site Closure</u>

The information regarding the predicted position of the carbon dioxide plume and associated pressure front at site closure, as required by 40 CFR 146.93(a)(2)(ii) is presented below.

The areal extent of the CO₂ plume increases during injection and for 2 years post-injection. As the areal extent decreases (at year 22), the plume migrates predominately upward. The computational modeling results indicate that the sequestered CO₂ will migrate above the Mount Simon Sandstone, into the Elmhurst as well as the lower part of the Lombard.

Figure 3 and Figure 4 show the upward migration of the CO₂ plume near the injection wells at 20 and 70 years. These two-dimensional images demonstrate various levels of gas saturation or upward migration into the injection zone (Mount Simon Formation, Elmhurst Sandstone, and the lower part of the Lombard). The computational model results indicate that the Model Layer "Lombard 5" is the top unit containing a fraction of injected CO₂ during the 100-year simulation. The top of the injection zone is set at 3,153 ft (below MSL) at the FutureGen stratigraphic well, corresponding to the top of the Lombard 5 layer of the numerical model.

The computational model estimates that the CO₂ plume forms a cloverleaf pattern as a result of the four lateral-injection-well design. The plume grows both laterally and vertically as injection continues. Most of the CO₂ resides in the Mount Simon Sandstone. A small amount of CO₂ enters into the Elmhurst and the lower part of the Lombard Formation. When injection ceases at 20 years, the lateral growth becomes negligible but the plume continues to move slowly primarily upward. Once CO₂ reaches the low-permeability zone in the upper Mount Simon it begins to move laterally.



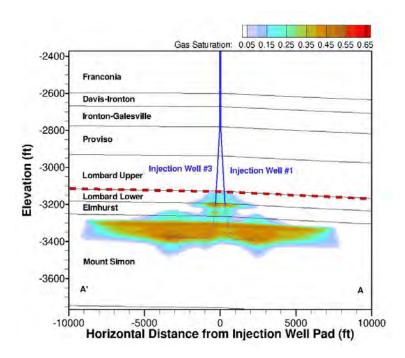


Figure 3. Cutaway view of CO₂-rich phase saturation along A-A' (Injection Wells 1 and 3) at 20 and 70 years. The red dashed line indicates the top of the injection zone.

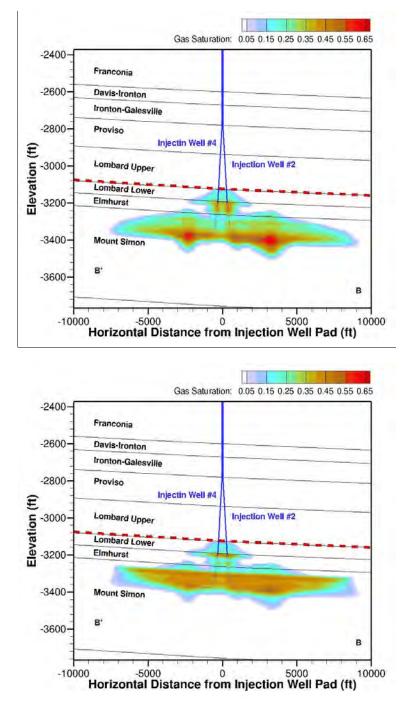


Figure 4. Cutaway view of CO₂-rich phase saturation along B-B' (Injection Wells 2 and 4) at 20 and 70 years. The red dashed line indicates the top of the injection zone.

Reservoir conditions are such that the CO₂ remains in the supercritical state throughout the domain and for the entire simulation period. The three-dimensional distribution of the CO₂-rich (or separate-) phase saturation is presented for selected times (i.e., 20 and 70 years). Additionally, to better illustrate the CO₂ migration through time and space, a cross-sectional view of the CO₂ plume is presented as slices through the center of the injection wells and along

the well traces. Figure 3 and Figure 4 show the CO₂-rich (or separate) phase saturation for selected times for slices A-A' and B-B', respectively.

The maximum pressure differential corresponds to the end of the injection period (year 20). After that time, the pressure slowly dissipates, resulting in the maximum pressure differential being below 30 psi at 70 years, and below 20 psi at 100 years. The pressure differential distribution has been presented instead of a defined pressure front because the calculated pressure head in the Mt. Simon is greater than the calculated pressure head in the lowermost underground source of drinking water (USDW), the St. Peter Sandstone, under initial conditions prior to injection. Figure 2 presents aqueous pressure differentials from baseline at the top of the injection zone and the extent of the carbon dioxide plume at 20 years after the start of injection (i.e., at site closure).

The model predicts that the areal extent of the CO₂ plume (defined as 99.0 percent of the separate-phase CO₂ mass) increases during injection and for 2 years post-injection and then begins to decrease as buoyancy forces dominate and plume migration is predominately upward. Figure 5 shows the cumulative area of the CO₂ mass plume with time. The maximum plume extent, 6.46 mi², occurs at 22 years after the start of injection (2 years after the cessation of injection).

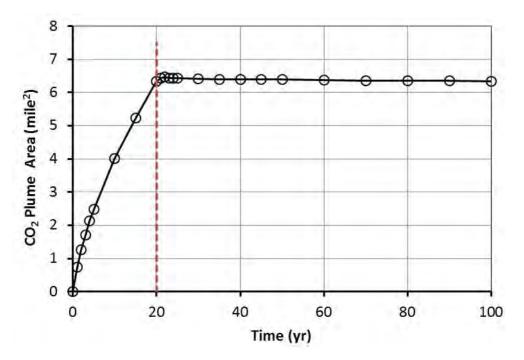


Figure 5. Simulated plume area over time (the vertical dashed line denotes the time CO₂ injection ceases).

The predicted extent of the CO_2 plume at the time of site closure, 50 years after the cessation of CO_2 injection, was determined from the computational model results.

Figure 6 shows the predicted areal extent of the CO_2 plume (defined as 99.0 percent of the separate-phase CO_2 mass) at the time of site closure. The simulation predictions show that 99.0 percent of the separate-phase CO_2 mass would be contained within an area of 6.35 mi² at the

time of site closure. This plume is only 1.7% smaller than the maximum plume area, which occurs at 22 years after the start of injection (Figure 5).

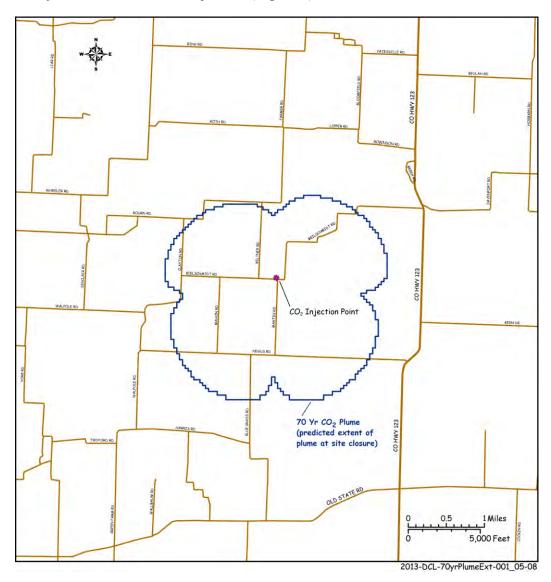


Figure 6. Simulated areal extent of the CO₂ plume at the time of site closure (70 years after CO₂ injection was initiated).

Post-Injection Monitoring Plan

FutureGen will perform post-injection monitoring, as required by 40 CFR 146.93(b), as described below.

Pressure monitoring of the injection zone will occur in three monitoring wells. The Testing and Monitoring Plan (Attachment C of this permit) describes the planned monitoring activities.

Quality assurance and surveillance measures:

Data quality assurance and surveillance protocols adopted by the project are designed to facilitate compliance with the requirements specified in 40 CFR 146.90(k). Quality Assurance (QA) requirements for direct measurements within the injection zone, above the confining zone, and within the shallow USDW aquifer that are critical to the post-injection monitoring, program (e.g., pressure and aqueous concentration measurements) are described in the Quality Assurance and Surveillance Plan (QASP) that is presented in Appendix G of the Testing and Monitoring Plan. These measurements will be performed based on best industry practices and the QA protocols recommended by the geophysical services contractors selected to perform the work.

Location of Monitoring Wells

Monitoring well locations are described in the Testing and Monitoring Plan (Attachment C of this permit). Their coordinates are provided in Appendix A of this plan. The objective of the monitoring program is to select and implement a suite of monitoring technologies that are both technically robust and provide an effective means of 1) evaluating CO₂ mass balance, 2) detecting any unforeseen containment loss, and 3) evaluating pressure changes in the reservoir to ensure that monitored values corroborate modeled expectations.

As part of the project's design optimization, the monitoring well network has been configured (Figure 7) to effectively monitor and account for the injected CO₂ and pressure changes. The design includes a total of nine monitoring wells:

- Two Above Confining Zone (ACZ) wells. These wells will be used to monitor immediately above the Eau Claire caprock in the Ironton Sandstone. Monitored parameters include: pressure, temperature, and hydrogeochemical indicators of CO₂ (Table 6).
- Two Single-Level in-Reservoir (SLR) wells (one of which is a reconfiguration of the previously drilled stratigraphic well). These wells will be used to monitor within the injection zone beyond the east and west ends of the horizontal CO₂-injection laterals. Monitored parameters include: pressure, temperature, and hydrogeochemical indicators of CO₂ (Table 6). One additional SLR well (a tenth monitoring well) will be installed outside of the expected CO₂ plume to monitor pressure effects in the injection zone.
- Three Reservoir Access Tubes (RAT) wells. These are fully cased wells, which allow access for monitoring instrumentation in the reservoir via pulsed neutron capture (PNC) logging equipment. To avoid two-phase flow near the borehole, which can distort the

- CO₂ saturation measurements, the wells will not be perforated. Monitoring parameters include: quantification of CO₂ saturation across the reservoir and caprock.
- One USDW well. This well will be used to monitor the lowermost USDW (the St. Peter Sandstone). Monitored parameters include: pressure, temperature, and hydrogeochemical indicators of CO₂ (Table 6).

Although monitoring of the shallow surficial aquifer is not required or anticipated during the post-injection period, the network remains available for monitoring activities should the need arise.

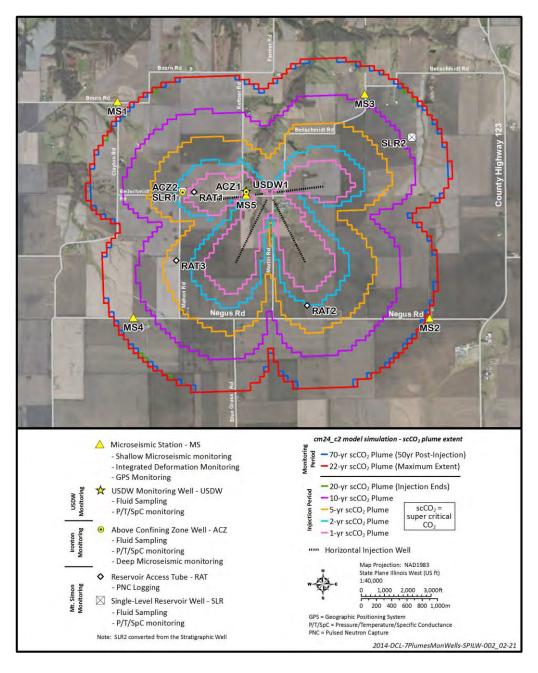


Figure 7. Map of monitoring well locations.

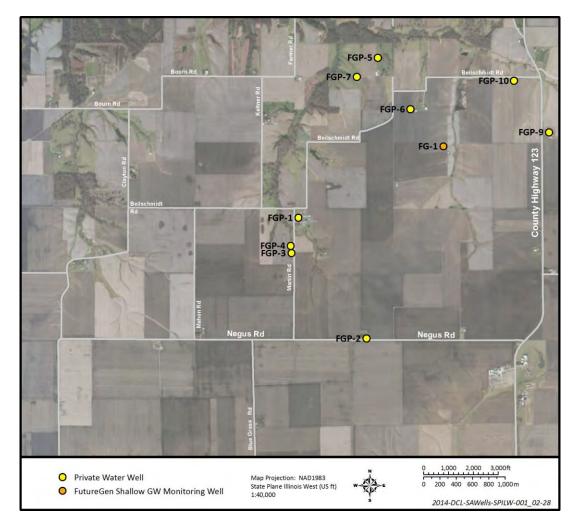


Figure 8. Surficial aquifer monitoring locations. Well FG-1 is a dedicated well drilled for the purposes of the FutureGen project, while wells FGP-1 through FGP-10 wells are local landowner wells.

Summary of Planned Post-Injection Monitoring Activities

The suite of indirect geophysical monitoring methods that will be used to monitor the areal extent, evolution, and fate and transport of the injected CO₂ plume during PISC include: PNC logging, passive seismic monitoring, integrated surface deformation monitoring, and time-lapse gravity surveys. Table 2 summarizes the testing and monitoring activities planned for the post-injection phase; collection and recording of continuous monitoring data will occur at the frequencies described in Table 13.

Table 2. Summary of post-injection monitoring activities.

Monitoring Category	Monitoring Method/Location	Frequency (Post-Injection Phase)
	Fluid sampling in surficial aquifers: 9 local landowner wells and 1 project-drilled well	None Planned
		Geochemistry Every 5 years
Groundwater Quality and Geochemistry Monitoring	Fluid sampling in St. Peter: one lowermost USDW well	Continuous temperature and pressure monitoring
		Geochemistry Every 5 years
	Fluid sampling in Ironton: two ACZ wells	Continuous temperature and pressure monitoring
	Fluid sampling in Mount Simon: SLR monitoring wells	Every 5 years
Injection Zone Monitoring	Pulsed-neutron capture (PNC) logging at 3 RAT wells	Every 5 years
	Pressure monitoring in Mount Simon: two SLR monitoring wells	Continuous
	Integrated deformation monitoring: five surface monitoring stations	Continuous
Indirect Geophysical Monitoring Techniques	Passive deep microseismic arrays in two ACZ wells and five seismometers in shallow cased bore holes.	Continuous
Note: For details and information	ation on continuous monitoring, see Table 13.	1

Groundwater Quality Monitoring

FutureGen will conduct groundwater sampling every 5 years according to the procedures described below.

Specific information concerning the sampling methods, analytical techniques, laboratories and quality assurance for sampling for the post-injection monitoring program are presented in the FutureGen QASP; see Table A.2 for Monitoring Tasks, Methods, and Schedule.

Sampling will take place at the frequencies specified in Table 3 (for the surficial aquifers), Table 4 (for the St. Peter), and Table 5 (for the Ironton). Because near-surface environmental impacts are not expected, surficial aquifer (<100 ft bgs) monitoring will only be conducted for a sufficient duration to establish baseline conditions (minimum of three sampling events) prior to start of the injection phase of the project.

- Surficial aquifer monitoring is not planned during the post-injection phase; however, the need for additional surficial aquifer monitoring will be continually evaluated throughout the operational phases of the project, and may be reinstituted if conditions warrant or if requested by the EPA UIC Program Director.
- Target parameters for the ACZ wells include pressure, temperature, hydrogeochemical indicators of CO₂, and brine composition (Table 6).
- Target parameters for the USDW and surficial aquifer wells include pressure, temperature, hydrogeochemical indicators of CO₂, and brine composition (Table 6).

If a leakage response is observed in the ACZ early-detection monitoring wells (Ironton) then the decision not to institute USDW aquifer triggers will be reevaluated based on the magnitude of the observed leakage response and predictive simulations of CO₂ transport between the Ironton and the St. Peter Formations.

Table 3. Sampling schedule for surficial aquifer monitoring wells.

Monitoring well name/location/map reference: Surficial aquifer monitoring wells Well depth/formation(s) sampled: Shallow glacial sediments (approx. 17 ft – 49 ft)		
Parameter/Analyte	Frequency (Post-Injection Phase)	
Dissolved or separate-phase CO ₂	None Planned	
Pressure	None Planned	
Temperature	None Planned	
Other parameters, including total dissolved solids, pH, specific conductivity, major cations and anions, trace metals, dissolved inorganic carbon, total organic carbon, carbon and water isotopes, and radon	None Planned	

Table 4. Sampling schedule for the USDW monitoring well.

Parameter/Analyte	Frequency (Post-Injection Phase)
Dissolved or separate-phase CO ₂	Every 5 years
Pressure	Continuous
Temperature	Continuous
Other parameters, including total dissolved solids, pH, specific conductivity, major cations and anions, trace metals, dissolved inorganic carbon, total organic carbon, carbon and water isotopes, and radon	Every 5 years
Note: For details and information on continuous monitoring, see Table 13.	

Table 5. Sampling schedule for ACZ monitoring wells.

Monitoring well name/location/map reference: Two ACZ monitoring wells (see Figure 7) Well depth/formation(s) sampled: Ironton Sandstone (3,470 ft)		
Parameter/Analyte	Frequency (Post-Injection Phase)	
Dissolved or separate-phase CO ₂	Every 5 years	
Pressure	Continuous	
Temperature	Continuous	
Other parameters, including total dissolved solids, pH, specific conductivity, major cations and anions, trace metals, dissolved inorganic carbon, total organic carbon, carbon and water isotopes, and radon	Every 5 years	
Note: For details and information on continuous monitoring, see Table 13.		

Note: collection and recording of continuous monitoring data will occur at the frequencies described in Table 13.

Sampling methods:

Sampling procedures are discussed below, and specific details are provided in the FutureGen QASP Table A.2.

During all groundwater sampling, field parameters (pH, specific conductance, and temperature) will be monitored for stability and used as an indicator of adequate well purging (i.e., parameter stabilization provides indication that a representative sample has been obtained). Calibration of field probes will follow the manufacturer's instructions using standard calibration solutions. A comprehensive list of target analytes and groundwater sample collection requirements is provided in Table 6. All analyses will be performed in accordance with the analytical requirements listed in Table 7. Additional analytes may be included for the shallow USDW based on landowner requests (e.g., coliform bacteria).

Table 6. Aqueous sampling requirements for target parameters.

Parameter	Volume/Container	Preservation	Holding Time
Major Cations: Al, Ba, Ca, Fe, K, Mg, Mn, Na, Si,	20-mL plastic vial	Filtered (0.45 μm), HNO ₃ to pH <2	60 days
Trace Metals: Sb, As, Cd, Cr, Cu, Pb, Se, Tl	20-mL plastic vial	Filtered (0.45 μm), HNO ₃ to pH <2	60 days
Cyanide (CN-)	250-mL plastic vial	NaOH to pH > 12, 0.6g ascorbic acid Cool 4°C,	14 days
Mercury	250-mL plastic vial	Filtered (0.45 μm), HNO ₃ to pH <2	28 days
Anions: Cl ⁻ , Br ⁻ , F ⁻ , SO ₄ ²⁻ , NO ₃ ⁻	125-mL plastic vial	Filtered (0.45 μm), Cool 4°C	45 days
Total and Bicarbonate Alkalinity (as CaCO ₃ ²⁻)	100-mL HDPE	Filtered (0.45 μm), Cool 4°C	14 days
Gravimetric Total Dissolved Solids (TDS)	250-mL plastic vial	Filtered (0.45 μm), no preservation, Cool 4°C	7 days
Water Density	100-mL plastic vial	No preservation, Cool 4°C	
Total Inorganic Carbon (TIC)	250-mL plastic vial	H ₂ SO ₄ to pH <2, Cool 4°C	28 days
Dissolved Inorganic Carbon (DIC)	250-mL plastic vial	Filtered (0.45 μ m), H ₂ SO ₄ to pH <2, Cool 4°C	28 days
Total Organic Carbon (TOC)	250-mL amber glass	Unfiltered, H ₂ SO ₄ to pH <2, Cool 4°C	28 days
Dissolved Organic Carbon (DOC)	125-mL plastic vial	Filtered (0.45 μ m), H ₂ SO ₄ to pH <2, Cool 4°C	28 days
Volatile Organic Analysis (VOA)	Bottle set 1: 3-40-mL sterile clear glass vials Bottle set 2: 3-40-mL sterile amber glass vials	Zero headspace, Cool <6 °C, Clear glass vials will be UV-irradiated for additional sterilization	7 days
Methane	Bottle set 1: 3-40-mL sterile clear glass vials Bottle set 2: 3-40-mL sterile amber glass vials	Zero headspace, Cool <6 °C, Clear glass vials (bottle set 1) will be UV- irradiated for additional sterilization	7 days
Stable Carbon Isotopes $^{13/12}$ C (δ^{13} C) of DIC in Water	60-mL plastic or glass	Filtered (0.45-μm), Cool 4°C	14 days
Radiocarbon ¹⁴ C of DIC in Water	60-mL plastic or glass	Filtered (0.45-μm), Cool 4°C	14 days
Hydrogen and Oxygen Isotopes $^{2/1}$ H (δ D) and $^{18/16}$ O (δ ¹⁸ O) of Water	60-mL plastic or glass	Filtered (0.45-μm), Cool 4°C	45 days

Parameter	Volume/Container	Preservation	Holding Time
Carbon and Hydrogen Isotopes (¹⁴ C, ^{13/12} C, ^{2/1} H) of Dissolved Methane in Water	1-L dissolved gas bottle or flask	Benzalkonium chloride capsule, Cool 4°C	90 days
Compositional Analysis of Dissolved Gas in Water (including N ₂ , CO ₂ , O ₂ , Ar, H ₂ , He, CH ₄ , C ₂ H ₆ , C ₃ H ₈ , iC ₄ H ₁₀ , nC ₄ H ₁₀ , iC ₅ H ₁₂ , nC ₅ H ₁₂ , and C ₆ +)	1-L dissolved gas bottle or flask	Benzalkonium chloride capsule, Cool 4°C	90 days
Radon (²²² Rn)	1.25-L PETE	Pre-concentrate into 20-mL scintillation cocktail. Maintain groundwater temperature prior to pre-concentration	1 day
pН	Field parameter	None	<1 h
Specific Conductance	Field parameter	None	<1 h
HDPE = high-density polyethylen	e; PETE = polyethylene to	erephthalate	

Table 7. Analytical requirements.

Table 7. Analytical requirements.				
Parameter	Analysis Method	Detection Limit or Range	Typical Precision/ Accuracy	QC Requirements
Major Cations: Al, Ba, Ca, Fe, K, Mg, Mn, Na, Si,	ICP-AES, EPA Method 6010B or similar	1 to 80 µg/L (analyte dependent)	±10%	Daily calibration; blanks, LCS, and duplicates and matrix spikes at 10% level per batch of 20
Trace Metals: Sb, As, Cd, Cr, Cu, Pb, Se, Tl	ICP-MS, EPA Method 6020 or similar	0.1 to 2 µg/L (analyte dependent)	±10%	Daily calibration; blanks, LCS, and duplicates and matrix spikes at 10% level per batch of 20
Cyanide (CN-)	SW846 9012A/B	5 μg/L	±10%	Daily calibration; blanks, LCS, and duplicates at 10% level per batch of 20
Mercury	CVAA SW846 7470A	0.2 μg/L	±20%	Daily calibration; blanks, LCS, and duplicates and matrix spikes at 10% level per batch of 20
Anions: Cl¯, Br¯, F¯, SO ₄ ² ¯, NO ₃ ¯	Ion Chromatography, EPA Method 300.0A or similar	33 to 133 μg/L (analyte dependent)	±10%	Daily calibration; blanks, LCS, and duplicates at 10% level per batch of 20
Total and Bicarbonate Alkalinity (as CaCO ₃ ²⁻)	Titration, Standard Methods 2320B	1 mg/L	±10%	Daily calibration; blanks, LCS, and duplicates at 10% level per batch of 20
Gravimetric Total Dissolved Solids (TDS	Gravimetric Method Standard Methods 2540C	10 mg/L	±10%	Balance calibration, duplicate samples
Water Density	ASTM D5057	0.01 g/mL	±10%	Balance calibration, duplicate samples
Total Inorganic Carbon (TIC)	SW846 9060A or equivalent Carbon analyzer, phosphoric acid digestion of TIC	0.2 mg/L	±20%	Quadruplicate analyses, daily calibration
Dissolved Inorganic Carbon (DIC)	SW846 9060A or equivalent Carbon analyzer, phosphoric acid digestion of DIC	0.2 mg/L	±20%	Quadruplicate analyses, daily calibration
Total Organic Carbon (TOC)	SW846 9060A or equivalent Total organic carbon is converted to carbon dioxide by chemical oxidation of the organic carbon in the sample. The carbon dioxide is measured using a non-dispersive infrared detector.	0.2 mg/L	±20%	Quadruplicate analyses, daily calibration
Dissolved Organic Carbon (DOC)	SW846 9060A or equivalent Total organic carbon is converted to carbon dioxide by chemical oxidation of the organic carbon in the sample. The carbon dioxide is measured using a non-dispersive infrared detector.	0.2 mg/L	±20%	Quadruplicate analyses, daily calibration
Volatile Organic Analysis (VOA)	SW846 8260B or equivalent Purge and Trap GC/MS	0.3 to $15~\mu g/L$	±20%	Blanks, LCS, spike, spike duplicates per batch of 20
Methane	RSK 175 Mod Headspace GC/FID	10 μg/L	±20%	Blanks, LCS, spike, spike duplicates per batch of 20
Stable Carbon Isotopes ^{13/12} C (1 ¹³ C) of DIC in Water	Gas Bench for ^{13/12} C	50 ppm of DIC	±0.2p	Duplicates and working standards at 10%

Parameter	Analysis Method	Detection Limit or Range	Typical Precision/ Accuracy	QC Requirements
Radiocarbon ¹⁴ C of DIC in Water	AMS for ¹⁴ C	Range: 0 i 200 pMC	±0.5 pMC	Duplicates and working standards at 10%
Hydrogen and Oxygen Isotopes $^{2/1}$ H (δ) and $^{18/16}$ O (1^{18} O) of Water	CRDS H ₂ O Laser	Range: - 500% to 200% vs. VSMOW	^{2/1} H: ±2.0‰ ^{18/16} O: ±0.3‰	Duplicates and working standards at 10%
Carbon and Hydrogen Isotopes (¹⁴ C, ^{13/12} C, ^{2/1} H) of Dissolved Methane in Water	Offline Prep & Dual Inlet IRMS for ¹³ C; AMS for ¹⁴ C	¹⁴ C Range: 0 & DupMC	¹⁴ C: ±0.5pMC ¹³ C: ±0.2‰ ^{2/1} H: ±4.0‰	Duplicates and working standards at 10%
Compositional Analysis of Dissolved Gas in Water (including N ₂ , CO ₂ , O ₂ , Ar, H ₂ , He, CH ₄ , C ₂ H ₆ , C ₃ H ₈ , iC ₄ H ₁₀ , nC ₄ H ₁₀ , iC ₅ H ₁₂ , nC ₅ H ₁₂ , and C ₆ +)	Modified ASTM 1945D	1 to 100 ppm (analyte dependent)	Varies by compon-ent	Duplicates and working standards at 10%
Radon (²²² Rn)	Liquid scintillation after pre- concentration	5 mBq/L	±10%	Triplicate analyses
pH	pH electrode	2 to 12 pH units	±0.2 pH unit For indication only	User calibrate, follow manufacturer recommendations
Specific Conductance	Electrode	0 to 100 mS/cm	±1% of reading For indication only	User calibrate, follow manufacturer recommendations

ICP-AES = inductively coupled plasma atomic emission spectrometry; ICP-MS = inductively coupled plasma mass spectrometry; LCS = laboratory control sample; GC/MS = gas chromatography-mass spectrometry; GC/FID = gas chromatography with flame ionization detector; AMS = accelerator mass spectrometry; CRDS = cavity ring down spectrometry; IRMS = isotope ratio mass spectrometry; LC-MS = liquid chromatography-mass spectrometry; ECD = electron capture detector

Laboratory to be used/chain-of-custody procedures:

Samples will be tracked using appropriately formatted chain-of-custody forms. The sample handling and chain of custody of water, formation fluids, and environmental gas or air samples will conform to EPA guidance, and be conducted as discussed in Sections B.1.3 and B.1.5 thru B.1.7 of the FutureGen QASP (Appendix G of the Testing and Monitoring Plan).

Plan for guaranteeing access to all monitoring locations:

The land on which the ACZ and USDW wells are located will either be purchased or leased for the life of the project, so access will be secured.

Access to the surficial aquifer wells will not be required over the lifetime of the project. Access to wells for baseline sampling has been on a voluntary basis by the well owner. Nine local landowners agreed to have their surficial aquifer wells sampled although sampling is not anticipated in surficial wells during the PISC period.

Carbon Dioxide Plume and Pressure-Front Tracking

Direct Pressure Monitoring:

FutureGen will conduct direct pressure-front monitoring to meet the requirements of 40 CFR 146.93(b). Continuous monitoring of injection zone pressure and temperature (P/T) will be performed with sensors installed in wells that are completed in the injection zone. P/T monitoring in the monitoring wells will be performed using a real-time monitoring system with surface readout capabilities so that pressure gauges do not have to be removed from the well to retrieve data.

The following measures will be taken to ensure that the pressure gauges are providing accurate information on an ongoing basis:

- High-quality (high-accuracy, high-resolution) gauges with low drift characteristics will be used
- Gauge components (gauge, cable head, cable) will be manufactured of materials designed to provide a long life expectancy for the anticipated downhole conditions.
- Upon acquisition, a calibration certificate will be obtained for every pressure gauge. The calibration certificate will provide the manufacturer's specifications for range, accuracy (% full scale), resolution (% full scale), drift (< psi per year), and calibration results for each parameter. The calibration certificate will also provide the date that the gauge was calibrated and the methods and standards used.
- Gauges will be installed above any packers so they can be removed if necessary for recalibration by removing the tubing string. Redundant gauges may be run on the same cable to provide confirmation of downhole pressure and temperature. Pressure gauges will be calibrated on an annual basis with current annual calibration certificates provided with test results to the EPA. In lieu of removing the injection tubing, the calibration of downhole pressure gauges will demonstrate accuracy by using a second pressure gauge, with current certified calibration, that will be lowered into the well to the same depth as the permanent downhole gauge. Calibration curves, based on annual calibration checks (using the second calibrated pressure gauge) developed for the downhole gauge, can be used for the purpose of the fall-off test. If used, these calibration curves (showing all historic pressure deviations) will accompany the fall-off test data submitted to the EPA.

- Upon installation, all gauges will be tested to verify they are functioning (reading/transmitting) correctly.
- Gauges will be pulled and recalibrated whenever a workover occurs that involves removal of tubing. A new calibration certificate will be obtained whenever a gauge is recalibrated.

Direct pressure monitoring in the injection zone will take place as indicated in Table 8. Collection and recording of continuous monitoring data will occur at the frequencies described in Table 13.

Table 8. Monitoring schedule for direct pressure-front tracking.

Well Location/Map Reference	Depth(s)/Formation(s)	Frequency (Post-Injection Phase)		
Two SLR monitoring wells (SLR Wells 1 and 2, see Figure 7)	Mount Simon/4,150 ft.	Continuous		
Note: For details and information on continuous monitoring, see Table 13.				

Direct Geochemical Plume Monitoring:

FutureGen will conduct direct CO₂ plume monitoring to meet the requirements of 40 CFR 146.93(b). Target parameters include pressure, temperature, and hydrogeochemical indicators of CO₂ (Table 6) and brine composition.

In addition to direct plume sampling and characterization, indirect montoring of the CO₂ plume will be conducted by continuing the periodic PNC logging across the injection zone and primary confining zone. PNC logging is a proven method for quantifying CO₂ saturation around a borehole. The PNC logging will be conducted using the three RAT wells. The RAT wells will be logged every 5 years during the post-injection period. Information collected will be compared with prior logs to determine trends.

Direct fluid sampling in the injection zone will take place as indicated in

Table 9 (collection and recording of continuous monitoring data will occur at the frequencies described in Table 13).

Table 9. Monitoring schedule for direct geochemical plume monitoring.

Monitoring well name/location/map reference: Two SLR monitoring wells (see Figure 7) Well depth/formation(s) sampled: Mount Simon Sandstone (4,150 ft)		
Parameter/Analyte	Frequency (Post-Injection Phase)	
Dissolved or separate-phase CO ₂	Every 5 years	
Pressure	Continuous	
Temperature	Continuous	
Other parameters, including major cations and anions, selected metals, and general water-quality parameters (pH, alkalinity, total dissolved solids, specific gravity)	Every 5 years	
Note: For details and information on continuous monitoring, see Table 13		

Sampling methods:

The FutureGen QASP and Testing and Monitoring Plan provide supplemental details about the sampling and analysis protocols for the direct fluid sampling that are outlined below.

Fluid samples will be collected from the monitoring wells completed in the injection zone as detailed in Table 9 above. Fluid samples will be collected using an appropriate method to preserve the fluid sample at injection zone temperature and pressure conditions. Examples of appropriate methods include using a bomb-type sampler (e.g., Kuster sampler) after pumped or swabbed purging of the sampling interval, using a Westbay sampler, or using a pressurized U-tube sampler (Freifeld et al. 2005).

Fluid samples will be analyzed for parameters that are indicators of CO₂ dissolution, including major cations and anions, selected metals, and general water-quality parameters (pH, alkalinity, TDS, specific gravity). Analysis of carbon and oxygen isotopes in injection zone fluids and the injection stream (^{13/12}C, ^{18/16}O) provides another potential supplemental measure of CO₂ migration. Where stable isotopes are included as an analyte, data quality and detectability will be reviewed throughout the active injection phase, and upon the UIC Program Director's approval, will be discontinued if these analyses provide limited benefit. Sampling and analytical requirements for target parameters are listed in Table 10 and Table 11, respectively.

Laboratory to be used/chain-of-custody procedures:

See FutureGen QASP Sections B.4.3 thru B.4.7.

Table 10. Aqueous sampling requirements for target parameters.

Parameter	Volume/Container	Preservation	Holding Time
Major Cations: Al, Ba, Ca, Fe, K, Mg, Mn, Na, Si,	20-mL plastic vial	Filtered (0.45 μm), HNO ₃ to pH <2	60 days
Trace Metals: Sb, As, Cd, Cr, Cu, Pb, Se, Tl	20-mL plastic vial	Filtered (0.45 μm), HNO ₃ to pH <2	60 days
Cyanide (CN-)	250-mL plastic vial	NaOH to pH > 12, 0.6g ascorbic acid Cool 4°C,	14 days
Mercury	250-mL plastic vial	Filtered (0.45 μm), HNO ₃ to pH <2	28 days
Anions: Cl ⁻ , Br ⁻ , F ⁻ , SO ₄ ²⁻ , NO ₃ ⁻	125-mL plastic vial	Filtered (0.45 μm), Cool 4°C	45 days
Total and Bicarbonate Alkalinity (as CaCO ₃ ²⁻)	100-mL HDPE	Filtered (0.45 μm), Cool 4°C	14 days
Gravimetric Total Dissolved Solids (TDS)	250-mL plastic vial	Filtered (0.45 μm), no preservation, Cool 4°C	7 days
Water Density	100-mL plastic vial	No preservation, Cool 4°C	
Total Inorganic Carbon (TIC)	250-mL plastic vial	H ₂ SO ₄ to pH <2, Cool 4°C	28 days
Dissolved Inorganic Carbon (DIC)	250-mL plastic vial	Filtered (0.45 μm), H ₂ SO ₄ to pH <2, Cool 4°C	28 days
Total Organic Carbon (TOC)	250-mL amber glass	Unfiltered, H ₂ SO ₄ to pH <2, Cool 4°C	28 days
Dissolved Organic Carbon (DOC)	125-mL plastic vial	Filtered (0.45 μm), H ₂ SO ₄ to pH <2, Cool 4°C	28 days
Volatile Organic Analysis (VOA)	Bottle set 1: 3-40-mL sterile clear glass vials Bottle set 2: 3-40-mL sterile amber glass vials	Zero headspace, Cool <6 °C, Clear glass vials will be UV-irradiated for additional sterilization	7 days
Methane	Bottle set 1: 3-40-mL sterile clear glass vials Bottle set 2: 3-40-mL sterile amber glass vials	Zero headspace, Cool <6 °C, Clear glass vials (bottle set 1) will be UV-irradiated for additional sterilization	7 days
Stable Carbon Isotopes $^{13/12}$ C $(\delta^{13}$ C) of DIC in Water	60-mL plastic or glass	Filtered (0.45-μm), Cool 4°C	14 days
Radiocarbon ¹⁴ C of DIC in Water	60-mL plastic or glass	Filtered (0.45-μm), Cool 4°C	14 days
Hydrogen and Oxygen Isotopes ^{2/1} H (δD) and	60-mL plastic or glass	Filtered (0.45-μm), Cool 4°C	45 days

Parameter	Volume/Container	Preservation	Holding Time	
^{18/16} O (δ ¹⁸ O) of Water				
Carbon and Hydrogen Isotopes (¹⁴ C, ^{13/12} C, ^{2/1} H) of Dissolved Methane in Water	1-L dissolved gas bottle or flask	Benzalkonium chloride capsule, Cool 4°C	90 days	
Compositional Analysis of Dissolved Gas in Water (including N ₂ , CO ₂ , O ₂ , Ar, H ₂ , He, CH ₄ , C ₂ H ₆ , C ₃ H ₈ , iC ₄ H ₁₀ , nC ₄ H ₁₀ , iC ₅ H ₁₂ , nC ₅ H ₁₂ , and C ₆ +)	1-L dissolved gas bottle or flask	Benzalkonium chloride capsule, Cool 4°C	90 days	
Radon (²²² Rn)	1.25-L PETE	Pre-concentrate into 20-mL scintillation cocktail. Maintain groundwater temperature prior to pre-concentration	1 day	
рН	Field parameter	None	<1 h	
Specific Conductance	Field parameter	None	<1 h	
HDPE = high-density polyethylene; PETE = polyethylene terephthalate				

Table 11. Analytical requirements.

Parameter	Analysis Method	Detection Limit or Range	Typical Precision/ Accuracy	QC Requirements
Major Cations: Al, Ba, Ca, Fe, K, Mg, Mn, Na, Si,	ICP-AES, EPA Method 6010B or similar	1 to 80 μg/L (analyte dependent)	±10%	Daily calibration; blanks, LCS and duplicates and matrix spikes at 10% level per batch of 20
Trace Metals: Sb, As, Cd, Cr, Cu, Pb, Se, Tl	ICP-MS, EPA Method 6020 or similar	0.1 to 2 μg/L (analyte dependent)	±10%	Daily calibration; blanks, LCS and duplicates and matrix spikes at 10% level per batch of 20
Cyanide (CN-)	SW846 9012A/B	5 μg/L	±10%	Daily calibration; blanks, LCS and duplicates at 10% level per batch of 20
Mercury	CVAA SW846 7470A	0.2 μg/L	±20%	Daily calibration; blanks, LCS and duplicates and matrix spikes at 10% level per batch of 20
Anions: Cl¯, Br¯, F¯, SO ₄ ² ¯, NO ₃ ¯	Ion Chromatography, EPA Method 300.0A or similar	33 to 133 μg/L (analyte dependent)	±10%	Daily calibration; blanks, LCS and duplicates at 10% level per batch of 20
Total and Bicarbonate Alkalinity (as CaCO ₃ ²⁻)	Titration, Standard Methods 2320B	1 mg/L	±10%	Daily calibration; blanks, LCS and duplicates at 10% level per batch of 20
Gravimetric Total Dissolved Solids (TDS	Gravimetric Method Standard Methods 2540C	10 mg/L	±10%	Balance calibration, duplicate samples
Water Density	ASTM D5057	0.01 g/mL	±10%	Balance calibration, duplicate samples
Total Inorganic Carbon (TIC)	SW846 9060A or equivalent Carbon analyzer, phosphoric acid digestion of TIC	0.2 mg/L	±20%	Quadruplicate analyses, daily calibration
Dissolved Inorganic Carbon (DIC)	SW846 9060A or equivalent Carbon analyzer, phosphoric acid digestion of DIC	0.2 mg/L	±20%	Quadruplicate analyses, daily calibration
Total Organic Carbon (TOC)	SW846 9060A or equivalent Total organic carbon is converted to carbon dioxide by chemical oxidation of the organic carbon in the sample. The carbon dioxide is measured using a non-dispersive infrared detector.	0.2 mg/L	±20%	Quadruplicate analyses, daily calibration
Dissolved Organic Carbon (DOC)	SW846 9060A or equivalent Total organic carbon is converted to carbon dioxide by chemical oxidation of the organic carbon in the sample. The carbon dioxide is measured using a non-dispersive infrared detector.	0.2 mg/L	±20%	Quadruplicate analyses, daily calibration
Volatile Organic Analysis (VOA)	SW846 8260B or equivalent Purge and Trap GC/MS	0.3 to $15~\mu g/L$	±20%	Blanks, LCS, spike, spike duplicates per batch of 20
Methane	RSK 175 Mod Headspace GC/FID	10 μg/L	±20%	Blanks, LCS, spike, spike duplicates per batch of 20
Stable Carbon Isotopes ^{13/12} C (1 ¹³ C) of DIC in Water	Gas Bench for ^{13/12} C	50 ppm of DIC	±0.2p	Duplicates and working standards at 10%

Parameter	Analysis Method	Detection Limit or Range	Typical Precision/ Accuracy	QC Requirements
Radiocarbon ¹⁴ C of DIC in Water	AMS for ¹⁴ C	Range: 0 i 200 pMC	±0.5 pMC	Duplicates and working standards at 10%
Hydrogen and Oxygen Isotopes $^{2/1}$ H (δ) and $^{18/16}$ O (1^{18} O) of Water	CRDS H ₂ O Laser	Range: - 500% to 200% vs. VSMOW	^{2/1} H: ±2.0‰ ^{18/16} O: ±0.3‰	Duplicates and working standards at 10%
Carbon and Hydrogen Isotopes (¹⁴ C, ^{13/12} C, ^{2/1} H) of Dissolved Methane in Water	Offline Prep & Dual Inlet IRMS for ¹³ C; AMS for ¹⁴ C	¹⁴ C Range: 0 & DupMC	¹⁴ C: ±0.5pMC ¹³ C: ±0.2‰ ^{2/1} H: ±4.0‰	Duplicates and working standards at 10%
Compositional Analysis of Dissolved Gas in Water (including N ₂ , CO ₂ , O ₂ , Ar, H ₂ , He, CH ₄ , C ₂ H ₆ , C ₃ H ₈ , iC ₄ H ₁₀ , nC ₄ H ₁₀ , iC ₅ H ₁₂ , and C ₆ +)	Modified ASTM 1945D	1 to 100 ppm (analyte dependent)	Varies by compon-ent	Duplicates and working standards at 10%
Radon (²²² Rn)	Liquid scintillation after pre- concentration	5 mBq/L	±10%	Triplicate analyses
pН	pH electrode	2 to 12 pH units	±0.2 pH unit For indication only	User calibrate, follow manufacturer recommendations
Specific Conductance	Electrode	0 to 100 mS/cm	±1% of reading For indication only	User calibrate, follow manufacturer recommendations

 $ICP-AES = inductively \ coupled \ plasma \ atomic \ emission \ spectrometry; \ ICP-MS = inductively \ coupled \ plasma \ mass \ spectrometry; \ LCS = laboratory \ control \ sample; \ GC/MS = gas \ chromatography-mass \ spectrometry; \ GC/FID = gas \ chromatography \ with \ flame \ ionization \ detector; \ AMS = accelerator \ mass \ spectrometry; \ CRDS = cavity \ ring \ down \ spectrometry; \ IRMS = isotope \ ratio \ mass \ spectrometry; \ LC-MS = liquid \ chromatography-mass \ spectrometry; \ ECD = electron \ capture \ detector$

Indirect Carbon Dioxide Plume and Pressure-Front Tracking

FutureGen will track the CO₂ plume and pressure front to meet the requirements of 40 CFR 146.93(b) using integrated deformation monitoring and passive seismic monitoring.

The frequency of indirect plume and pressure-front monitoring activities during the post-injection phase, is given in Table 12 (collection and recording of continuous monitoring data will occur at the frequencies described in Table 13). The coordinates of the monitoring wells/stations are provided in Appendix C of this Plan.

Monitoring Technique	Location	Frequency (Post-Injection Phase)
Integrated deformation monitoring	5 locations (see Figure 7)	Continuous
Passive seismic monitoring (microseismicity)	Surface measurements (see Figure 7) plus downhole sensor arrays at ACZ Wells 1 and 2	Continuous

Table 12. Monitoring schedule for indirect plume and pressure-front monitoring.

Integrated deformation monitoring

Integrated deformation monitoring integrates ground data from permanent Global Positioning System (GPS) stations, and tiltmeters, supplemented with annual Differential GPS (DGPS) surveys, and larger-scale Differential Interferometric Synthetic Aperture Radar (DInSAR) surveys to detect and map temporal ground-surface deformation. These data reflect the dynamic geomechanical behavior of the subsurface in response to CO₂ injection. These measurements will provide useful information about the evolution and symmetry of the pressure front. These results will be compared with model predictions throughout the operational phase of the project and significant deviation in observed response would result in further action, including a detailed evaluation of the observed response, calibration/refinement of the numerical model, and possible modification to the monitoring approach and/or storage site operations. Integrated deformation monitoring will take place at the locations shown in Figure 7.

Passive seismic monitoring (microseismicity)

The objective of the microseismic monitoring network (Figure 7; five stations and downhole arrays in the two ACZ wells) is to accurately determine the locations, magnitudes, and focal mechanisms of any potential injection-induced seismic events with the primary goals of 1) addressing public and stakeholder concerns related to induced seismicity, 2) estimating the spatial extent of the pressure front from the distribution of any potential seismic events, and 3) identifying features that may indicate areas of caprock failure and possible containment loss. The Emergency and Remedial Response Plan (Attachment F to this permit) provides additional information about seismic monitoring).

Table 13. Sampling and Recording Frequencies for Continuous Monitoring.

Well Condition	Minimum sampling frequency: once every	Minimum recording frequency: once every
For operating injection wells that are required to monitor continuously:	5 seconds	5 minutes ¹
For injection wells that are shut-in:	4 hours	4 hours
For monitoring wells (USDW, ACZ, SLR):	30 minutes	2 hours

¹ This can be an average of the sampled readings over the previous 5-minute recording interval, or the maximum (or minimum, as appropriate) value identified over that recording interval

Notes:

Sampling frequency refers to how often the monitoring device obtains data from the well for a particular parameter. For example, a recording device might sample a pressure transducer monitoring injection pressure once every two seconds and save this value in memory.

Recording frequency refers to how often the sampled information gets recorded to digital format (such as a computer hard drive). Following the same example above, the data from the injection pressure transducer might be recorded to a hard drive once every minute.

Proposed Schedule for Submitting Post-Injection Monitoring Results

During the PISC period, monitoring reports will be prepared and submitted to the EPA Region 5 UIC office annually. The reports will summarize methods and results of the groundwater-quality monitoring, CO₂ storage zone pressure tracking, and indirect geophysical monitoring for CO₂ plume tracking. See Table 14.

Table 14. Post-injection phase reporting schedule.

Planned Testing/Monitoring	Reporting Schedule
Groundwater Quality Monitoring Data	Annual
Carbon Dioxide Plume and Pressure-Front Tracking Data	Annual
Direct Pressure Monitoring Data	Annual
Indirect Carbon Dioxide Plume and Pressure- Front Tracking Data	Annual

The PISC and Site Closure Plan will be reviewed every 5 years during the PISC period (e.g., concurrent with or as a result of 5-year reevaluations of the AoR). Results of the plan review will

be included in the PISC monitoring reports. Monitoring and operational results will be reviewed for adequacy in relation to the objectives of PISC monitoring. The monitoring locations, methods, and schedule will be analyzed in relation to the size of the CO₂ storage zone, pressure front, and protection of USDWs. In case of changes to the PISC plan, a modified plan will be submitted to the EPA Region 5 UIC Branch Office for not less than 30 days prior to the planned intiation of the changes.

Alternative Post-Injection Site Care Time Frame

FutureGen is not requesting an alternative PISC time frame. As indicated in Section O(6)(b)(v) of this permit, the permittee shall continue to conduct post-injection site monitoring for at least 50 years or for the duration of any alternative timeframe approved pursuant to 40 CFR 146.93(c).

Non-Endangerment Demonstration Criteria

Prior to approval of the end of the PISC period, FutureGen will submit a demonstration of non-endangerment of USDWs to the UIC Program Director (40 CFR 146.93(b)(3)).

FutureGen will issue a report to the UIC Program Director. This report will make a demonstration of USDW non-endangerment based on the evaluation of the site monitoring data used in conjunction with the project's computational model. The report will include information detailing how the non-endangerment demonstration evaluation uses site-specific conditions to confirm and demonstrate non-endangerment. The report will include all relevant monitoring data and interpretations upon which the non-endangerment demonstration is based and any other information necessary for the UIC Program Director to replicate the analysis. The report will include the sections discussed below.

Summary of Existing Monitoring Data

A summary of all previous monitoring data at the site, including data collected during the injection and PISC phases of the project, will be submitted to help demonstrate non-endangerment. Data submittals will be in a format acceptable to the UIC Program Director (40 CFR 146.91(e)), and will include a narrative explanation of monitoring activities, including the dates of all monitoring events, changes to the monitoring program over time, and an explanation of all monitoring infrastructure that has existed at the site.

Comparison of Monitoring Data and Model Predictions and Model Documentation

The results of computational modeling used for AoR delineation will be compared to monitoring data collected during the operational and the PISC period. Monitoring data will also be compared with baseline data collected during site characterization, per 40 CFR 146.82(a)(6) and 146.87(d)(3). The data used to update the computational model and to monitor the site will include both direct (e.g., temporal measurements of pressure, temperature, groundwater quality, and injection zone fluid composition) and indirect geophysical methods (e.g., passive seismic and integrated deformation monitoring, PNC logging). Data generated during the PISC

period will be used to show that the computational model accurately represents the storage site and can be used as a proxy to determine the plume's properties and size. FutureGen will demonstrate this degree of accuracy by comparing the monitoring data obtained during the PISC period against the model's predicted properties (i.e., plume location, rate of movement, and pressure decay). Statistical methods will be employed to correlate the data and confirm the model's ability to accurately represent the storage site. The validation of the computational model with the large volume of available data will be a significant element to support the nonendangerment demonstration. Further, the validation of the complete model over the areas, and at the points, where direct data collection has taken place will ensure confidence in the model for those areas where surface infrastructure preclude geophysical data collection and where there are no direct observation wells.

Evaluation of Carbon Dioxide Plume

FutureGen will use a combination of monitoring data, logs, geophysical surveys, and seismic methods to locate and track the movement of the CO₂ plume. The data produced by these activities will be compared against the modeled predictions (see Figure 6) using statistical methods to validate the model's ability to accurately represent the storage site. Regarding the separate-phase carbon dioxide plume, the PISC monitoring data will show the stabilization of the CO₂ plume as the reservoir pressure returns to its near pre-injection state. For the separatephase carbon dioxide plume, the risk to USDWs will decrease when the extent of pure-phase carbon dioxide ceases to grow either laterally or vertically. The stabilization of the plume combined with the lack of local penetrations of the confining formation will be significant factors in FutureGen's demonstration of non-endangerment. Furthermore, FutureGen's monitoring wells screened above the confining layer may be used to determine aqueous-phase concentrations of carbon dioxide and mobilized constituents in order to assess USDW endangerment. If a demonstration can be made, in conjunction with monitoring data, that a vast majority of the carbon dioxide has been immobilized via trapping mechanisms, this is strong evidence that the risk to USDWs posed by the carbon dioxide plume has decreased. Modeling may also be used to estimate future plume migration. Modeling results, including sensitivity analyses, may be used to demonstrate that plume migration rates are negligible based on available site characterization, monitoring, and operational data.

Evaluation of Mobilized Fluids

In addition to carbon dioxide, mobilized fluids may pose an ongoing risk to USDWs. These include native fluids that are high in TDS and therefore may impair a USDW, and fluids containing mobilized drinking water contaminants (e.g., arsenic, mercury, hydrogen sulfide). The geochemical data collected from monitoring wells will be used to demonstrate that no mobilized fluids have moved above the confining formation and, therefore after the PISC period, would not pose a risk to USDWs. Of particular importance are any monitoring wells that are screened above the primary confining zone, within any USDWs, and in the vicinity of any known leakage pathways. Monitoring data indicating steady or decreasing trends of potential drinking water contaminants below actionable levels (e.g., secondary and maximum contaminant levels) will be used for this demonstration. In order to demonstrate nonendangerment, FutureGen will compare the operational and PISC period samples of the

lowermost USDW against the pre-injection baseline samples. This comparison will show that no significant changes have occurred in the fluid properties of the overlying formations. This will demonstrate that no mobilized formation fluids have moved through the confining formation. This validation of confining zone integrity will demonstrate that the injectate and/or mobilized fluids would not represent an endangerment to any USDWs.

Evaluation of Reservoir Pressure

FutureGen will also demonstrate non-endangerment to USDWs by showing that during the PISC period, the pressure within the Mount Simon rapidly decreases to its near pre-injection static reservoir pressure. Because the increased pressure is the primary driving force for fluid movement that may endanger a USDW, the decay in the pressure differentials will provide strong justification that the injectate no longer poses a risk to any USDWs.

FutureGen will monitor the downhole reservoir pressure at various locations and intervals using a combination of surface and downhole pressure gauges. The measured pressure at a specific depth interval will be compared against the pressure predicted by the computational model (see Figures 1 and 2). Agreement between the actual and the predicted values will validate the accuracy of the model and further demonstrate non-endangerment.

Evaluation of Potential Conduits for Fluid Movement

Other than the project and monitoring wells, other distant potential conduits for fluid movement, or leakage pathways within the AoR are adequately constructed and/or plugged. Based on this information, the potential for fluid movement through artificial penetrations of the confining formation does not present a risk of endangerment to any USDWs.

Evaluation of Passive Seismic Data

Seismic monitoring will be used to further demonstrate confining formation integrity. FutureGen will provide seismic monitoring data showing that no seismic events have occurred that would indicate fracturing or fault activation near or through the confining formation. This validation of confining zone integrity will provide further support to demonstrate that the CO₂ plume is no longer an endangerment to any USDWs, by indicating that the response to the imposed fluid pressures due to injection are confined to the vicinity of the injection zone and below.

Site Closure Plan

FutureGen will conduct site closure activities to meet the requirements of 40 CFR 146.93(e). Site closure will occur at the end of the PISC period. Site closure activities will include decommissioning surface equipment, plugging monitoring wells, restoring the site, and preparing and submitting site closure reports.

The EPA Region 5 UIC Branch Office will be notified at least 120 days before site closure. In addition, state and local agencies including the Illinois State Geological Survey and Illinois

Department of Natural Resources, as well as City of Jacksonville and Morgan County agencies will be notified prior to the scheduled site closure. At this time, there are no federally recognized Native American Tribes located within the AoR or the State of Illinois. If a federally recognized Native American Tribe exists in the AoR or the State of Illinois at the time of site closure, it will be notified of site closure at that time.

A revised site closure plan will be submitted to the EPA Region 5 UIC Branch Office and state and local (and tribal) governmental agencies, if any changes have been made to the original site closure plan. After site closure is authorized, site closure field activities will be completed.

Planned Remedial/Site Restoration Activities

At the end of the PISC phase, FutureGen will ensure the site is reclaimed and returned to predevelopment condition to meet the requirements of 40 CFR 146.93(e).

Surface equipment decommissioning will occur in two phases: the first phase will occur after the active injection phase, and the second phase will occur at the end of PISC phase. The surface facilities at the storage site will include the Site Control Building and the APS (Annulus Pressurization System) Building.

At the end of the active injection period, plume monitoring will continue, but there will be no further need for the pumping and control equipment. The Site Control Building will be demolished. All features will be removed except the APS Building, a 12-ft-wide access road with five parking spaces, a concrete sidewalk from the parking lot to the building, underground electrical and telephone services, and a chain-link fence surrounding the building. The common wall between the APS Building and the Site Control Building will be converted to an exterior wall. The injection wells will be plugged and capped below grade (see the Injection Well Plugging Plan in Attachment D of this permit). The gravel pad will be removed. The APS Building at the storage site will be repurposed to act as the collection node for data from the plume monitoring equipment. The building will contain equipment to receive real-time data from the monitoring wells and other monitoring stations and send the data via an internet connection to be analyzed offsite during the 50-year post-injection monitoring period.

All surface facilities will be removed at the end of the PISC phase. These facilities will include the APS Building, the access road with parking spaces, all sidewalks, underground electrical and telephone services, and fencing at the injection well sites. The site will be reclaimed and returned to predevelopment condition.

Soil will be backfilled around the monitoring and geophysical wells to bring the area around the wells back to pre-well-installation grade. Any remaining surface facilities associated with the monitoring well will be reclaimed and the area will be returned to predevelopment condition. All gravel pads, access roads, and surface facilities will be removed, and the land will be reclaimed for agricultural or other beneficial pre-construction uses.

Plugging the Monitoring Wells

Upon conclusion of the post-injection site care period (~50 years), all monitoring wells will be plugged and capped below grade in accordance with the approved monitoring well Plugging and Abandonment Plans (see Appendix E of this Plan). All deep monitoring wells at the site will be plugged to prevent any upward migration of the CO₂ or formation fluids into USDWs. Each of the deep monitoring wells will be plugged and abandoned using best practices to prevent communication of fluids between the injection zone and USDWs. The deep monitoring wells in the injection interval have a direct connection between the injection formation and ground surface. The well-plugging program is designed to prevent communication between the injection zone and the USDWs.

Before the wells are plugged, the internal and external integrity of the wells will be confirmed by conducting cement-bond, temperature, and noise logs on each of the wells. In addition, a pressure fall-off test will be performed above the perforated intervals (where present) to confirm well integrity. The results of the logging and testing will be reviewed and approved by appropriate regulatory agencies prior to plugging the wells.

The wells with perforations (the SLR monitoring wells, the ACZ monitoring wells, and lowermost USDW monitoring well) will be plugged using a CO₂-resistant cement retainer method to cement the perforated intervals and a balanced plug method to cement the well above the perforated zones and the cement retainer. The RAT monitoring wells will not have perforations; therefore, only the balanced plug method will be used to plug these wells. Once the interior of the casing has been properly plugged with cement, the casing will be cut off below ground and capped. Regulations at the time of the plugging and abandonment will dictate the specifications regarding the depth at which the casing is cut and the method used to cap the well. The cap will be inscribed with the well identification number and the date of plug and abandonment.

Plugging the Geophysical Wells

The FutureGen microseismic and deformation monitoring designs include five geophysical monitoring stations. Two types of well completions will be constructed at each of the five geophysical monitoring stations: both well types will be completed as sealed access tubes designed to support downhole installation of either microseismic or tiltmeter instrumention in a subsurface moisture free environment. Well construction and plugging schematics showing the exposed formation intervals, casing diameters, casing depths, depths to USDWs, and the placement of all plugs are presented for each well type in Figure 9.

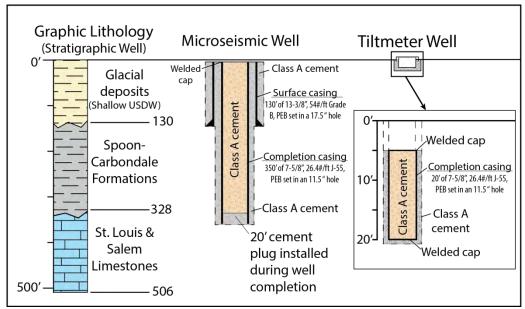


Figure 9. Diagram of Microseismic and Tiltmeter Wells After Plugging and Abandonment.

Upon conclusion of the post-injection site care period, all geophysical wells will be plugged and capped below grade in accordance with the approved monitoring well Plugging and Abandonment Plans (see Appendix E of this plan). All downhole instrumentation will be removed and each microseismic well casing and tiltmeter well casing will be plugged with cement to ensure that the well does not provide a conduit to the shallow USDW zone or ground surface. The procedures for plugging and abandoning both types of wells are very similar. However, cement volumes will differ depending upon the total depth of the well.

For both well-completion designs, class A cement will be used to plug the well casing. The geophysical wells will not have perforations; therefore, the balanced plug method will be used to plug these wells. Once the interior of the casing has been properly plugged with cement, the casing will be cut off below ground and capped. Regulations at the time of the plugging and abandonment will dictate the specifications regarding the depth at which the casing is cut and the method used to cap the well. The cap will be inscribed with the well identification number and the date of plug and abandonment.

The methods and materials described in this plan are based upon current understanding of the geology at the site and current well designs. If necessary, the plans will be updated to reflect the latest well designs. These new designs, materials, and methods will be described in the Notice of Intent to Plug submitted at least 60 days prior to the plugging of the wells.

After the completion of the plugging activities, a plugging report will be submitted to the UIC Program Director describing the methods used and tests performed on the well during plugging. This report will be submitted to the UIC Program Director within 60 days of completing the plugging activities.

Site Closure Reporting

A site closure report will be submitted to the EPA Region 5 UIC Branch Office and the previously notified state and local regulatory agencies within 90 days of site closure. The site closure report will include the following information:

- Documentation of appropriate well plugging, including a survey plat of the injection well location;
- Documentation of the well-plugging report to Illinois and local agencies that have authority over drilling activities at the facility site; and
- Records reflecting the nature, composition, and volume of the CO₂ injected in UIC wells.

In association with site closure, a record of notation on the facility property deed will be added to provide any potential purchaser of the property with the following information:

- Notification that the subsurface was used for CO₂ storage;
- The name of the Illinois and local agencies and the EPA Region 5 Branch Office to which the survey plat was submitted; and
- The volume of fluid injected, the injection zone, and the period over which injection occurred.

PISC and site closure records will be retained for 10 years after site closure. At the conclusion of the 10-year period, these records will be delivered to the EPA Region 5 UIC Branch Office for further storage.

APPENDIX A: Deep Monitoring Well Locations

Well ID	Well Type	Latitude (WGS84)	Longitude (WGS84)
ACZ1	Above Confining Zone 1	39.80034315	-90.07829648
ACZ2	Above Confining Zone 2	39.80029543	-90.08801028
USDW1	Underground Source of Drinking Water	39.80048042	-90.0782963
SLR1	Single-Level in-Reservoir 1	39.8004327	-90.08801013
SLR2	Single-Level in-Reservoir 2	39.80680878	-90.05298062
RAT1	Reservoir Access Tube 1	39.80035565	-90.08627478
RAT2	Reservoir Access Tube 2	39.78696855	-90.06902677
RAT3	Reservoir Access Tube 3	39.79229199	-90.08901656

APPENDIX B: Surficial Aquifer Monitoring Well Locations

Well ID	Well Type	Latitude	Longitude
FG-1	FutureGen Shallow Monitoring Well	39.80675	-90.05283
FGP-1	Private Well	39.79888	-90.0736
FGP-2	Private Well	39.78554	-90.0639
FGP-3	Private Well	39.79497	-90.0746
FGP-4	Private Well	39.79579	-90.0747
FGP-5	Private Well	39.81655	-90.0622
FGP-6	Private Well	39.81086	-90.057560
FGP-7	Private Well	39.81444	-90.065241
FGP-9	Private Well	39.80829	-90.0377
FGP-10	Private Well	39.81398	-90.0427

APPENDIX C: Microseismic Monitoring and Integrated Deformation Station Locations

Well ID/Station ID	Well/Station Type	Latitude (WGS84)	Longitude (WGS84)
MS1	Microseismic monitoring Station 1(shallow borehole)Integrated deformation monitoring station	39.8110768	-90.09797015
MS2	Microseismic monitoring Station 2 (shallow borehole)Integrated deformation monitoring station	39.78547402	-90.05028403
MS3	 Microseismic monitoring Station 3 (shallow borehole) Integrated deformation monitoring station 	39.81193502	-90.06016279
MS4	 Microseismic monitoring Station 4 (shallow borehole) Integrated deformation monitoring station 	39.78558513	-90.09557015
MS5	 Microseismic monitoring Station 5 (shallow borehole) Integrated deformation monitoring station 	39.80000524	-90.07830287
ACZ1	· Deep microseismic station (deep borehole)	39.80034315	-90.07829648
ACZ2	Deep microseismic station (deep borehole)	39.80029543	-90.08801028

APPENDIX D: Planned Construction Design and Plugging and Abandonment Plan Diagrams for Deep Monitoring Wells and Reservoir Access Tube Wells

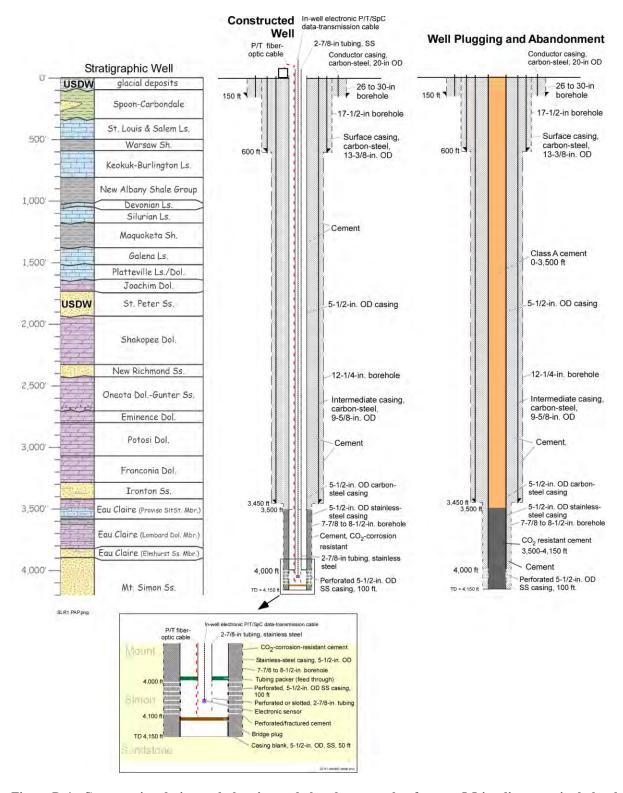


Figure D-1. Construction design and plugging and abandonment plan for new 5.5-in.-diameter single-level in-reservoir monitoring well.

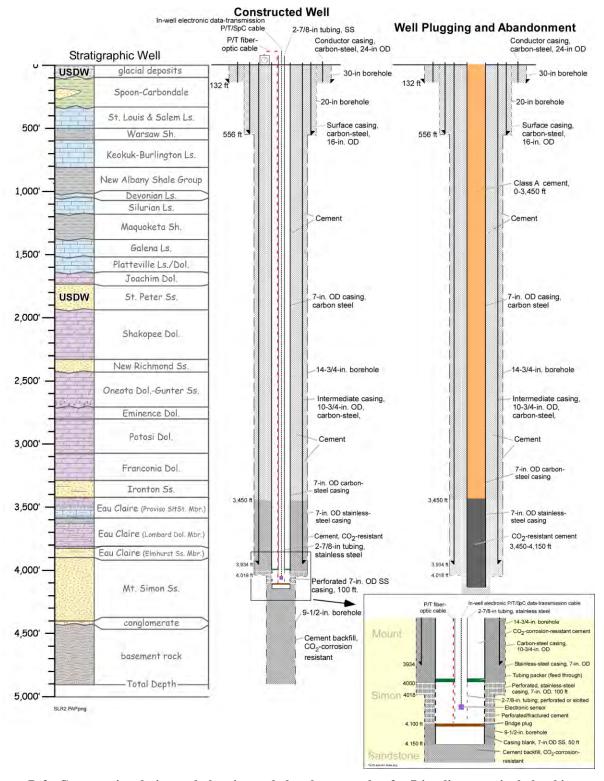


Figure D-2. Construction design and plugging and abandonment plan for 7-in.-diameter single-level inreservoir monitoring well to be reconfigured from the stratigraphic well.

Constructed Well

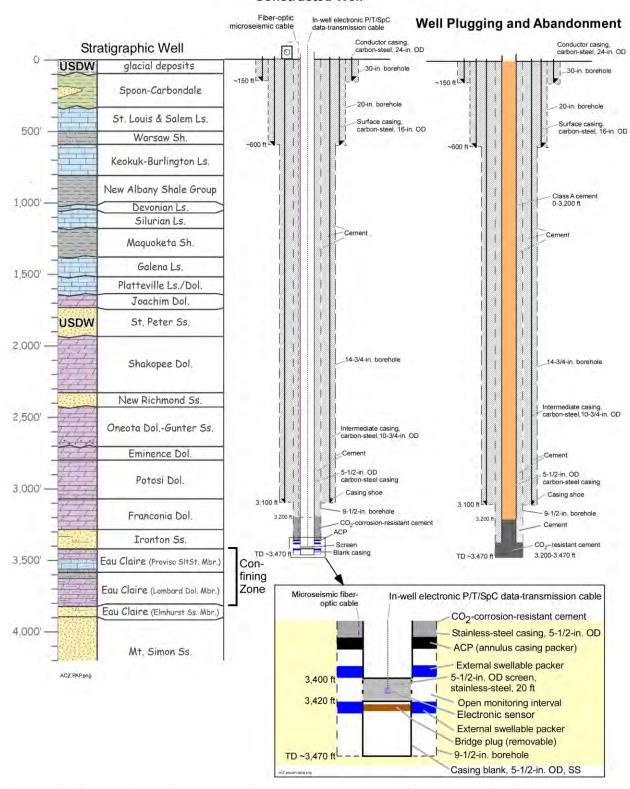


Figure D-3. Construction design and plugging and abandonment plan for the Above Confining Zone monitoring wells.

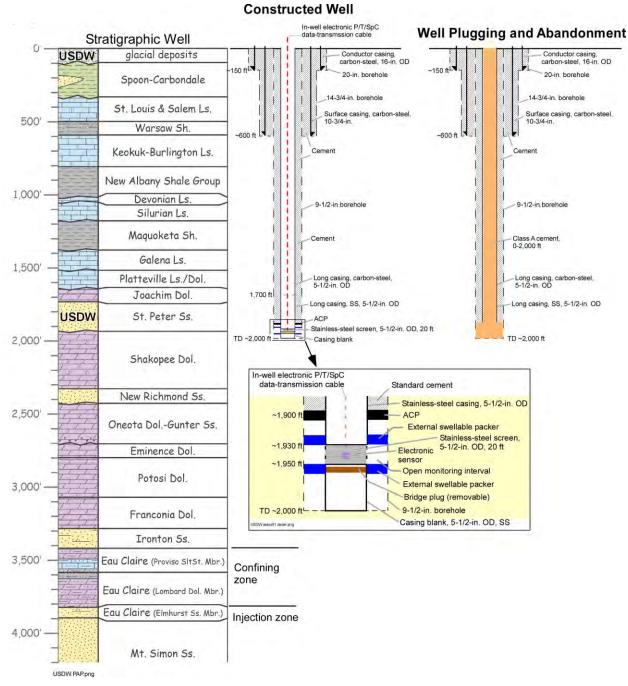


Figure D-4. Construction design and plugging and abandonment plan for the USDW monitoring well.

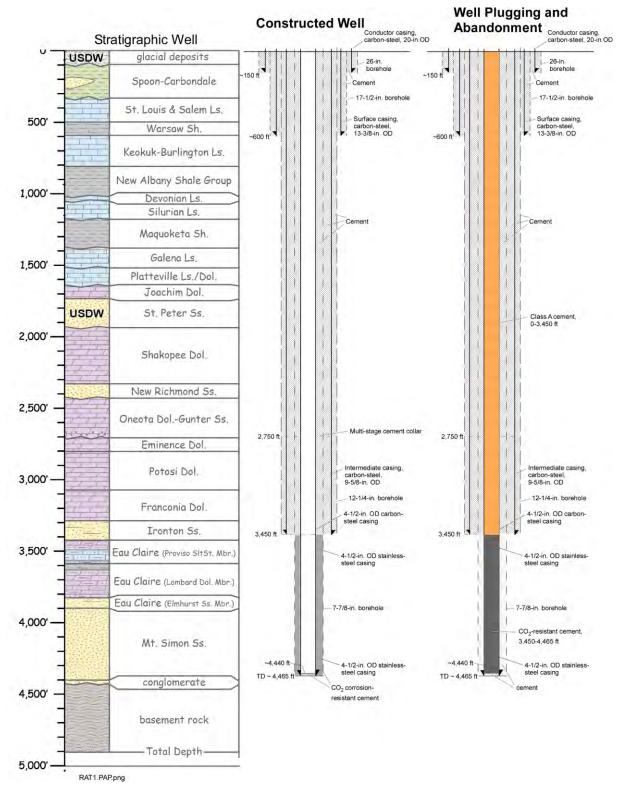


Figure D-5. Construction design and plugging and abandonment plan for the reservoir access tube wells.

APPENDIX E:Plugging and Abandonment Plans for Deep Monitoring Wells, Reservoir Access Tube Wells, and Geophysical Wells

Plugging and abandonment plans for the following monitoring wells are provided in this appendix:

Monitoring wells

- ACZ1
- ACZ2
- RAT1
- RAT2
- RAT3
- SLR1-5.5"
- SLR2-7"
- USDW1

Geophysical Wells

- MS1
- MS2
- MS3
- MS4
- MS5
- TM1
- TM2
- TM3
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Measured Top of Plug (if tagged ft.)				3,450'		0'									
Slurry Wt. (Lb./Gal.)				15.82		15.6									
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			PLU	GGING	ANI	O AB				ENT PL					
	and Address of F		on County II							ss of Owner	/Operator				
KA	□ Well, FutureG	reii 2.0, Moig	an County, 11.					utureGen . 3 Central			st, Jacksonv	ille, IL 626	50		
	Locate Well and O	utline Unit on		Sta						unty		Permit Number			
	Section Plat - 640 A				linois				M	organ					
		N			_	ocation [_					
	!!!	T ! !	- !	se	1/4 0	f ne 1/4	4 of	f <u>ne</u> 1/4 o	of S	e 1/4 of	Section 34	Township	16n Range	9w	
	_+		- <u>+</u> -	Lo	cate we	ell in two	dir	rections fro	om	nearest line	s of quarter	section and	drilling unit		
	_	_L _'_:	_	Sui	rface _										
	1 1 1	1 ; ;		Lo	cation	ft. fi	rm ((N/S)	Lin	e of quarter	section				
		╌┠╌┼╌╏	-+-	and	d 1	ft. from (E/W	V)Lin	e of	f quarter se	ction.				
w	- i - i - i	- 		_ [_	_			JTHORIZAT	ION	l			CTIVITY		
		-	idual Pe	erm i	it			CLAS							
			Permit					CLAS							
	-+	╌┠╌┼╌┟	-+-		Rule	:						rine Dispos:			
		_ -	_ _	l N	Number	of Wells	1					nhanced Re ydrocarbon			
	1 1 1	1!!	!								CLAS		Storage		
l '		S		l e	ase Nan	ne					Well Numi				
\vdash	CA	SING AND TUE	ING RECORD						П	METH			F CEMENT PL	ugs	
SIZI	WT (LB/FT)	TO BE PUT II	WELL (FT)	TO BE LEF	T IN WE	ELL (FT)	Т	HOLE SIZI	E	✓ The	e Balance Me	thod			
20"	94	0-150		150			26"				Dump Baile				
13-3	/8 61	0-600		600			1	17.5"			Two-Plug N				
9-5/	36	0-3,450		3,450			1	12.25"		Oth	_				
4-1/2	10.5	0-4,465		4,465			1 7	7.875"							
	CEMENTING	TO PLUG AND	ABANDON DAT	A:		PLUG #	¥1	PLUG #2	<u> </u>	PLUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #7	
_	of Hole or Pipe in			iche	4.5" 4.5"										
_	to Bottom of Tub				4,440' 3,450'										
_	of Cement To Be Volume To Be Pu		ig)		-	79 89	-	262 309	4						
_	lated Top of Plug				-+	3,450	-	0	╣						
_	red Top of Plug (i				-	3,450		0	╡						
_	Wt. (Lb./Gal.)	,			\neg	15.82		15.6	┪						
	Cement or Other N	Material (Class	III)			EverCr	et		7						
	LIS	T ALL OPEN H	OLE AND/OR P	ERFORATE	D INTE	RVALS A	ND	INTERVAL	S V	WHERE CAS	ING WILL BE	VARIED (if a	ny)		
	From			То						From			То		
Eetim	ated Cost to Plug	Malle							_						
	8,830	weiis													
\$50															
-															
					(Certific	at	ion							
	I certify under the	e penalty of lav	/ that I have pe	rsonally ex	xamine	and am	far	miliar with	the	inform atio	n submitted	in this docur	nent and all		
	attachments and	that, based on	my inquiry of	those indiv	viduals	immedia	ately	y responsi	ble	for obtainir	ng the inform	ation, I beli	eve that the		
	information is tru possibliity of fine					:: e a [e 5	gril	птані реп	aıtl	es IVI SUDM	rung laise l	mormation,	noluumg Me	•	
Name	and Official Title	(Please type o	r print)		Sian	ature							Date Signed		
				r]["		41	4 7	4	Hun	dues.	<			
	neth K. Humphreys, Chief Executive Officer **Rush ** **Hunghreys*** 03/03/2014****														

	OMB No. 2040-0042 Approval Expires 11/30/2014 United States Environmental Protection Agency																
9	F	PA				011110				DC 20460	,,,	geney					
					P	UGGII	NG AN	D AB				ENT PL					
		d Address			~ .				ш			ess of Owner	/Operator				
We.	II S.	LR1, Futi	ureG	en 2.0, Morg	an Count	7, IL				FutureGen 73 Central			st, Jacksonv	ille, IL 626	550		
		ato Moll a	nd O	utline Unit o			State					unty		Permit	ermit Number		
		tion Plat -					Illinois				Μ	organ					
				N			Surface I	Location	De	scriptior				_			
		1 1	Ţ		 	1	SW 1/4	SW 1/4 of SW 1/4 of SW 1/4 of SW 1/4 of Section 26 Township 16n Range 9w									
	L.	<u> </u>	ļ.	- -	느냐_		Locate w	ell in two	o di	irections fr	om	nearest line	s of quarter	section and	drilling unit		
	Ε.	+	+-	- !-		Location	ft.	frm	(N/S)	Lin	e of quarter	section					
	┝.	<u> </u>	<u> </u>	- F	느+ㅡ		and	ft. from				f quarter se					
		!!			! !	l_		TYPE O	FΑ	UTHORIZAT				WELL A	ACTIVITY		
W	W E V								ern	n it			CLAS	SS I			
													CLAS	SS II			
	L.	∔–⊢	<u> </u>	-⊩-∔	⊢∔−		Rul	e						rine Dispos	al		
		i i	i	1 1	ii		Numbe	r of Well	. 1				□ □	nhanced Re	covery		
Hydrocarbon CLASS III										Storage							
(+) <u>i i</u>	<u> i </u>	<u> </u>	<u>i i </u>	J							CLAS	SS III			
		•		S			Lease Na	am e					Well Numl	er			
			CA	SING AND TU	BING REC	ORD AFTER	PLUGGIN	G				METH	OD OF EMPL	ACEMENT O	F CEMENT PI	LUGS	
SIZ	E	WT (LB/	FT)	TO BE PUT	IN WELL (F	T) TO BE	LEFT IN W	ELL (FT)	Ц	HOLE SIZ	E	✓ The	Balance Me	thod			
20"		94		0-150		150			4	26"	_	The Dump Bailer Method					
13-3	=			0-600		600			-	17.5"	4	The	Two-Plug N	lethod			
9-5/	_	36		0-3,450		3,450		12.25" Other									
5-1/2	2"	17		0-4,150		4,150				8"	4				1		
Cina	-611			TO PLUG AN				PLUG #1 PLUG #2 PLUG #3 PLUG #4 PLUG #5 PLUG #6								PLUG #7	
_	_			which Plug W ing or Drill P		ea (Inche		5-1/2" 5-1/2" 4,150' 3,500'									
_				Used (each p				78	_	388	۲						
_				mped (cu. ft.				87		458	╡						
_		ed Top of I			<u> </u>			3.500	_	0'	Ħ						
Meas	ure	d Top of P	lug (i	f tagged ft.)				3,500		0'							
Slurr	y W	t. (Lb./Gal	l.)					15.82		15.6							
Туре	Cer	nent or Ot	her N	faterial (Class	i III)			EverC	ret	Class A							
			LIS	T ALL OPEN	HOLE AND	OR PERFO	RATED INT	ERVALS	AN	D INTERVAL	LS \	WHERE CAS	ING WILL BE	VARIED (if a	uny)		
		Fre	om			Тс						From			То		
400)'				4100' (1	perforated	and fractu	red)	Ė								
									Ľ								
									H								
Ection	stimated Cost to Plug Wells																
	\$536,600																
922																	
\vdash																	
								Certifi	ca	tion							
	Ιc	ertify unde	er the	penalty of la	w that I ha	ve persona	lly examine	ed and ar	n fa	amiliar with	the	inform atio	ı submitted i	in this docur	nent and all		
	att	achments	and	that, based o	n my inqui	ry of those	individual	s immedi	iate	ely responsi	ible	for obtainir	ig the inform	ation, I beli	eve that the		
				e, accurate, a and impriso				nere are s	sigi	niticant pen	ıalti	es tor subm	ıπıng false i	ntormation,	including the	•	
Name	_				· ·			nature							Date Signed		
Izell	neth K. Humphreys, Chief Executive Officer **Rull H. Hunghays** 03/03/2014																

									OIM	IB No. 2040⊣	0042 AP	orovai Expire	s 11/30/2014			
				United	i States Environmental Protection Agency Washington, DC 20460											
8	EPA		PLU	GGIN		_			ME	ENT PL	AN					
Name	and Address of Fa	cility					Na	Name and Address of Owner/Operator								
We	1 SLR2, FutureG	en 2.0, Morga	n County, II	_				utureGen								
							7	73 Central	Pa	rk Plaza Ea	st, Jackson	ville, IL 626	550			
	Locate Well and O	utlina Unit an			State								mit Number			
	Section Plat - 640 A			L	Illinois				M	organ						
ı		N			Surface L	.ocation	Des	scriptior		_						
	<u> </u>	<u> </u>	Ţ.		nw 1/4 c	ne 1	4 0	of <u>ne</u> 1/4 c	of S	se 1/4 of	Section 25	Township	16n Range	9w		
ı		- ┠ - ┼ ─ ┞		l.	Locate well in two directions from nearest lines of quarter section and drilling unit											
ı	_		Surface													
ı		Location	ft. f	rm	(N/S)	Lin	e of quarter	section								
ı		╼┠╾╶┽╼╌╏		and	ft. from ((E/V	W) Lin	ie of	f quarter se	ction.						
w			E	Г				UTHORIZAT	ION	I		WELL	ACTIVITY			
"	i i i	II i i	- 1		vidual P	erm	ı it			CLA						
ı		- 	- 1	_	Permit					CLA						
		-IIii		- 1	Rul	е						rine Dispos				
	ii	_L_i_i		- 1	Number	of Wells	1					nhanced Re				
ı		- - i		- 1								lydrocarbon 	Storage			
		S S	- 1							T L CLA	SS III					
		5		l	Lease Na	m e					Well Num	ber				
	CA	SING AND TUE	ING RECORD	AFTER P	LUGGING	3			П	METH	OD OF EMPL	ACEMENT O	F CEMENT PI	_UGS		
SIZ	WT (LB/FT)	TO BE PUT IN	WELL (FT)	TO BE L	EFT IN W	ELL (FT)	Т	HOLE SIZ	E	☑ The	e Balance Me	thod				
24"	140	0-132		132			i	30"			e Dump Baile					
16"	84	0-556		556			20"				e Two-Plug N					
10-3	/4 51	0-3,934		3.934			T	14.75"		Other						
7"	29	4,150		4,150				9.5"								
Г	CEMENTING	TO PLUG AND	ABANDON DA	TA:		PLUG	#1	PLUG #2	2	PLUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #7		
Size	of Hole or Pipe in v	vhich Plug Wil	I Be Placed (i	nche		7"		7"								
Depti	to Bottom of Tub	ing or Drill Pi	e (ft			4,150'										
Sack	of Cement To Be	Used (each plu	Ig)			124		619								
_	/ Volume To Be Pu					139	_	730								
_	lated Top of Plug					3,500'		0'	4							
_	ured Top of Plug (i	t tagged ft.)				3,500'		0'	4							
_	/ Wt. (Lb./Gal.) Cement or Other N	Istorial (Class	III)			15.82		15.6	4							
туре				DEDES -	TED	EverC		•		MIEDE 64 -		NA PIES "				
<u> — </u>	From	T ALL OPEN H	OLE AND/OR	PERFORA To	I EU INTE	KVALS /	AND	INTERVAL		WHERE CAS From	ING WILL BE	VARIED (if a	To			
400			4100' (perf		d fractiv	red)					_					
400	,		1100 (peri	or and a all	наста	eu,			_		-					
Estin	ated Cost to Plug	Wells														
\$571,600																
								4.								
					1	Certifi	cai	tion								
	I certify under the															
		e, accurate, ar	nd complete.	l am awai	re that th	viduals immediately responsible for obtaining the information, I believe that the that there are significant penalties for submitting false information, including the 2)										
Name	and Official Title	(Piease type o	r print)		Sign	nature							Date Signed			
	neth K. Humphre			er		×	1	utt	Z	Hu	ngluer	1.5	03/03/2014			
		, ~, CINCI IAC				- 1		-ce	- "	- ,			03/03/2014			
	orm 7520-14 (Rev	_														

Permit Number

WELL ACTIVITY

PLUG #6

PLUG #7

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32)

possibility of fine and imprisonment. (Ref. 40 CFR 144.02)	
Name and Official Title <i>(Please type or print)</i>	Signature	Date Signed
Kenneth K. Humphreys, Chief Executive Officer	Kutt K. Hundreys	03/03/2014
	<u> </u>	

EPA Form 7520-14 (Rev. 12-11)

US EPA ARCHIVE DOCUMENT

\$EPA

OMB No. 2040-0042 Approval Expires 11/30/2014												
	ted States E				Agency							
I≎EPA	Wa	shington	, DC 2046)								
PLUGGI	NG AN	D AB	ANDO	NΜ	ENT PL	AN						
Name and Address of Facility			Name and	Addr	ess of Owne	r/Operator						
Well MS1, FutureGen 2.0, Morgan County, IL			FutureG	en Al	liance							
,,,,		- 11				st, Jackson	ville, IL 62650					
	Tai i											
Locate Well and Outline Unit on	State Illinois				ounty forces		Permit	Number				
Section Plat - 640 Acres					1organ							
N	Surface L	ocation [Descriptio	r								
	se 1/4 c	of se 1/4	4 of <u>ne</u> 1	/4 of	nw 1/4 of	Section 27	Township	16n Range	9w			
┃ ├ ┴─└┴─┞┴─└┴─│	Locate w	Locate well in two directions from nearest lines of quarter section and drilling unit										
	1	· · · · · · · · · · · · · · · · · · ·										
│	Surface			٦.,								
	Location		rm (N/S)		ne of quarter							
	and	ft. from (of quarter se	ction.						
w			AUTHORI	ZATIO	N			ACTIVITY				
		vidual Pe	rm it			CLA						
		a Permit				CLA	SS II					
┃ ├─┽─├─┼─╟─┽─├─┼─ ┃	Rul	e				<u> </u>	Brine Dispos	al				
	N	r of Wells	1			E	nhanced Re	covery				
┃ ┝┽╼┝┽╼┠┽╼┡┽╼┃	Number	rorwells				□ F	lydrocarbon	Storage				
						CLA	SS III					
S Lease Name Well Number												
Lease Name Well Number												
CASING AND TUBING RECORD AFTE	R PLUGGING	3			METH	OD OF EMPL	ACEMENT O	FCEMENTPI	LUGS			
SIZE WT (LB/FT) TO BE PUT IN WELL (FT) TO B	E LEFT IN W	ELL (FT)	HOLE	SIZE	1	e Balance Me	ethod					
13-3/8 54 0-130 130			17.5"		1 =	e Dump Baile						
7-5/8 26.4 0-350 350			11.5"		1 =	e Two-Plug N						
					Ott	_	icaiou					
		- John John John John John John John John										
CEMENTING TO PLUG AND ABANDON DATA:		PLUG #	1 PLU	. 40	PLUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #7			
Size of Hole or Pipe in which Plug Will Be Placed (inche		7-5/8"	, I FLOT	3 mZ	FLOG #5	FLOG #4	FLOG #5	FLOG #6	FLOG #7			
Depth to Bottom of Tubing or Drill Pipe (ft		330	_									
Sacks of Cement To Be Used (each plug)		74	_									
			_									
Slurry Volume To Be Pumped (cu. ft.)		87	_	_								
Calculated Top of Plug (ft.)		0	_	_								
Measured Top of Plug (if tagged ft.)		0	_									
Slurry Wt. (Lb./Gal.)		15.6	_									
Type Cement or Other Material (Class III)		Class A										
LIST ALL OPEN HOLE AND/OR PERFO	RATED INTE	ERVALS A	ND INTER	VALS	WHERE CAS	ING WILL BE	VARIED (if a	ıny)				
From T	0				From			То				
Estimated Cost to Plug Wells												
\$25,000	\$25,000											
		Certific	ation									
Lastific condentina namelina of last that I have name	aller arramina		familian n	ماه هاه		اد مخفقه ساده م	in thin dearm					
I certify under the penalty of law that I have person: attachments and that, based on my inquiry of those												
information is true, accurate, and complete. I am a	ware that th								•			
possibliity of fine and imprisonment. (Ref. 40 CFR	144.32)											
Name and Official Title <i>(Please type or print</i>)	Sign	nature						Date Signed				
Kenneth K. Humphreys, Chief Executive Officer												
		71-1	utt	1	- Muser	Juney	~	55/55/2014				

United States Environmental Protection Agency Washington, DC 20460												
PLUGGIN	IG AN	D AB										
Name and Address of Facility Well MS2, FutureGen 2.0, Morgan County, IL			Name and A		ess of Owner liance	/Operator						
			73 Centra	ıl Pa	ırk Plaza Ea	st, Jacksonv	ille, IL 626	550				
Locate Well and Outline Unit on	State Illinois				ounty Lorgan		Permit	ermit Number				
Section Plat - 640 Acres		.ocation	Description	Morgan								
N			-	of	SW 1/4 of	Section 31	Township	16n Range	9w			
┃ ├ ╶┼─├─┼─ ┠ ╶┼─├─┼─┃ ┃	Locate well in two directions from nearest lines of quarter section and drilling unit											
┃ ├ ╶╁─├─╁─ ┠ ╶╁─├─┼─┃ ┃	Surface											
	Location		rm (N/S)		ne of quarter							
	and	ft. from (AUTHORIZA		of quarter se	stion.	WELL A	ACTIVITY				
W E	✓ Indi	vidual P	erm it			CLAS	SS I					
▋ ▕▕▔┤▔├▔┤▔ ┟ づ▔├▔┤▔│ │	Arez	Permit				CLAS						
┃ ├─┼─├─┼─┠─┼─├─┼─ ┃ ┃							rine Dispos: nhanced Re					
						CLAS	S III					
s	Lease Na	m e				Well Numl	er					
CASING AND TUBING RECORD AFTER PLUGGING METHOD OF EMPLACEMENT OF CEMENT PLUGS												
	LEFT IN W	ELL (FT)	HOLE SI	ZE	✓ The	Balance Me	thod					
13-3/8 54 0-130 130 7-5/8 26.4 0-350 350			17.5"	-	1 =	The Dump Bailer Method The Two-Plug Method						
7-3/6 20.4 9-350 330			11.5	+	Oth	_	lethod					
CEMENTING TO PLUG AND ABANDON DATA:		PLUG	#1 PLUG	#2	PLUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #7			
Size of Hole or Pipe in which Plug Will Be Placed (inche		7-5/8"	_									
Depth to Bottom of Tubing or Drill Pipe (ft Sacks of Cement To Be Used (each plug)		74	_									
Slurry Volume To Be Pumped (cu. ft.)		87	_									
Calculated Top of Plug (ft.)		0										
Measured Top of Plug (if tagged ft.)		0										
Slurry Wt. (Lb./Gal.)		15.6										
Type Cement or Other Material (Class III) LIST ALL OPEN HOLE AND/OR PERFOR	ATED INTE	Class		AL C	WHERE CAS	NC WILL BE	VARIED 65 -	lm()				
From To	WIED IN IE	RVALS /	AND INIEKV	413	From	ING WILL BE	AWKIED (IL 9	To				
		_										
Estimated Cost to Plug Wells												
\$25,000												
Certification I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32)												
Name and Official Title (Please type or print)	Sigr	nature					I	Date Signed				
Kenneth K. Humphreys, Chief Executive Officer **North M. Humphreys												

\$EPA	United States Environmental Protection Agency Washington, DC 20460 PLUGGING AND ABANDONMENT PLAN											
	GGING	AND										
Name and Address of Facility Well MS3, FutureGen 2.0, Morgan County, IL			F	ame and Ac FutureGen 73 Central	Allia	nce	•	rille, IL 626	550			
Locate Well and Outline Unit on	Stat				Coun			Permit Number				
Section Plat - 640 Acres		Illinois Morgan Surface Location Description										
N N		7			of nw	V 1/4 of	Section 25	Township	16n Range	9w		
w = = = = = = = = = = = = = = = = = = =	Sur Loc and	TYPE OF AUTHORIZATION ✓ Individual Permit ☐ Area Permit ☐ Rule ☐ Brine Disposal ☐ Enhanced Recovery						ACTIVITY al covery				
▋ ▕▔▝▔┞┈┆┈ ┠ ╶┆┈┆┈┆		umber of	well's <u>-</u>				CLAS	lydrocarbon SS III	Storage			
s	Lea	se Name					Well Numi					
CASING AND TUBING RECORD	AFTER PLU	GGING			Т	METHOD OF EMPLACEMENT OF CEMENT PLUGS						
SIZE WT (LB/FT) TO BE PUT IN WELL (FT)	TO BE LEFT	T IN WEL	L (FT)	HOLE SIZ	E	✓ The Balance Method						
13-3/8 54 0-130	130			17.5" The Dump Bailer Method								
7-5/8 26.4 0-350	350			11.5"		The	Two-Plug N	lethod				
					_	Other						
CEMENTING TO PLUG AND ABANDON DA			LUG #1	PLUG #	2 P	LUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #7		
Size of Hole or Pipe in which Plug Will Be Placed (i	nche	_	-5/8"	+	+							
Depth to Bottom of Tubing or Drill Pipe (ft Sacks of Cement To Be Used (each plug)		7	30	+	+							
Slurry Volume To Be Pumped (cu. ft.)		8		+	+							
Calculated Top of Plug (ft.)		0		+	7							
Measured Top of Plug (if tagged ft.)		0			7							
Slurry Wt. (Lb./Gal.)		1.	5.6									
Type Cement or Other Material (Class III)		C	lass A									
LIST ALL OPEN HOLE AND/OR	PERFORATE	D INTERV	ALS AN	D INTERVA	LS WH	IERE CASI	NG WILL BE	VARIED (if a	uny)			
From	То				Fr	om			То			
							-					
			-				-					
Estimated Cost to Plug Wells												
\$25,000												
Certification I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32)												
Name and Official Title <i>(Please type or print</i>)		Signat	ure	,					Date Signed			
Kenneth K. Humphreys, Chief Executive Officer Kuell H. Humphreys 03/03/2014												

PLUGGING AND ABANDONMENT PLAN Value and Address of Facility Well MS4, FutureOen 2.0, Morgan County, IL. State PutureOen 2.0, Morgan County, IL. PutureOen 2.0, Morgan PutureOen 2.0, Morg	OMB No. 2040-0042 Approval Expires 11/30/2014 United States Environmental Protection Agency																
PLUGGING AND ABANDONMENT PLAN Well MS4, FutureGen 2.0, Morgan County, IL Locate Well and Quitine Unit on Section Plat -640 Acres Surface Location Description Wild of Ise Lat on Swill 4 or Ise Lat on Swill 4 or Ise Lat on Swill 1 or Ise La	₽F	PΔ									,						
Published Alliance To Central Park Plaze East, Jacksonville, IL 62650	~_	.,,		PLU	GGIN	IG AN	D AB	Αl	NDON	VIE	ENT PL	AN					
State The Plaze East, Jacksonville, IL 52650 State The Plaze East, Jacksonvill												/Operator					
Locate Well and Outline Unit on Section FIX. 466 Acres N Surface Location Descriptor Surface Location Descriptor Surface Location Descriptor Surface Location Descriptor Surface Location To Section (34) Township (16) Range (9w) Locate well in two directions from nearest lines of quarter section and drilling unit Surface Location Tr. frm (NS) Line of quarter section And Tr. from (EW) Line of quarter section And Tr. from (EW) Line of quarter section MELLACTIVITY CLASS II GLASS II GLASS II GLASS II GRID AND TUBING RECORD AFTER PLUGGING Well Area Permit Rute Number of Wells 1 Area Permit Area	Well M	4S4, FutureGe	n 2.0, Morgai	i County, IL								st, Jackson	ille, IL 626	550			
Surface Location Description Surfac	Lo	cate Well and O	utline Unit on											Number			
N	Sec	ction Plat - 640 A	cres				a a vinti a v										
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Lease Name Well Number	-	<u> </u>	-1 (+) -i					_		_		CLAS	SS III				
SIZE WT (LB/FT) TO BE PUT IN WELL (FT) TO BE LEFT IN WELL (FT) HOLE SIZE 3-3/8 5-4			S			Lease Na	me					Well Num	per				
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Depth to Bottom of Tubing or Drill Pipe (ft 330	01								PLUG #2	2	PLUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #7		
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Type Cement or Other Material (Class III) LIST ALL OPEN HOLE AND/OR PERFORATED INTERVALS AND INTERVALS WHERE CASING WILL BE VARIED (if any) From To From To From To Standard Cost to Plug Wells \$25,000 Certification I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am ware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32) Name and Official Title (Please type or print) Signature Date Signed	Measure	d Top of Plug (i	f tagged ft.)				0										
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				Protection	n Ager	ncy						
ŞEPA PLUGGIN		shingtor DAB			/IEN	IT PL/	ΔN					
Name and Address of Facility		Name and Address of Owner/Operator										
Well MS5, FutureGen 2.0, Morgan County, IL			Fut	tureGen A	Allian	ıce						
			73			ark Plaza East, Jacksonville, IL 62650						
	State Illinois				County F Morgan			Permit	Permit Number			
Section Plat - 640 Acres			_		Mulg	gan						
N I	Surface L			-		7	2.4			0		
	SW 1/4 of SW 1/4 of SW 1/4 of Se 1/4 of Section 26 Township 16n Range 9w											
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	Location	ft. f	rm (N	1/S)I	Line of	of quarter	section					
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┃ ├ ┴─┴┴─┠┴─└┴─┃	Number	of Wells	1					ydro carbon				
							CLAS	•	Jiorage			
 												
	Lease Nar	ne			_		Well Numb	er				
CASING AND TUBING RECORD AFTER PLUGGING METHOD OF EMPLACEMENT OF CEMENT PLUGS												
SIZE WT (LB/FT) TO BE PUT IN WELL (FT) TO BE L	EFT IN WI	ELL (FT)	-	IOLE SIZE		✓ The Balance Method						
13-3/8 54 0-130 130			17.5" The Dump Bailer Method									
7-5/8 26.4 0-350 350			11	1.5"	4	The	Two-Plug M	ethod				
			+		4	Oth	er					
CEMENTING TO PLUG AND ABANDON DATA: Size of Hole or Pipe in which Plug Will Be Placed (inche		PLUG :	\rightarrow	PLUG #2	PL	LUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #7		
Depth to Bottom of Tubing or Drill Pipe (ft		330	-		╫							
Sacks of Cement To Be Used (each plug)		74	_		+							
Slurry Volume To Be Pumped (cu. ft.)		87										
Calculated Top of Plug (ft.)		0										
Measured Top of Plug (if tagged ft.)		0										
Slurry Wt. (Lb./Gal.)		15.6			4							
Type Cement or Other Material (Class III)		Class 2										
LIST ALL OPEN HOLE AND/OR PERFORA	ATED INTE	RVALS	AND I	INTERVAL	S WHE		NG WILL BE	VARIED (if a	ny) To			
From 10					Fro	əm			10			
			H									
Estimated Cost to Plug Wells												
\$25,000												
	-	Certific	rati.	on			_	_				
	I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the											
information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the												
possibliity of fine and imprisonment. (Ref. 40 CFR 14-	4.32)											
Name and Official Title (Please type or print)	Sign	ature	,		_	/	,	T	Date Signed			
Kenneth K. Humphreys, Chief Executive Officer		ブ	·u	itt	Hi.	Hu	nglue	15	03/03/2014			

OMB No. 2040-0042 Approval Expires 11/30/2014 United States Environmental Protection Agency																	
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				PLU	JGGIN	IG AN	D AB				ENT PL						
		Address of Fa	acility n 2.0, Morgai	2 County II							ss of Owner	/Operator					
We	11 110	vii, ruiuieGe	ii 2.0, ivioigai	i County, ii					utureGen . 73 Central			st, Jacksonv	ille, IL 626	50			
	Loca	ate Well and O	utline Unit on			State					unty		Permit	Number			
		ion Plat - 640 A				Illinois	4.	_		M	organ						
ı			N			Surface L			_	-		27		12	0		
ı										-		Section 27		16n Range	9W		
ı	┝-	╅━┝╌╅╸	┰╁╌┼	-+-		Locate well in two directions from nearest lines of quarter section and drilling unit											
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ı	L.	1_L1.	<u> </u>			Location	ft. from				e of quarter						
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ı		1 1 1	1 ; ;	- 1		Number	of Well:	1					nhanced Re				
ı	Γ-	†	- 					_					ydrocarbon	Storage			
ı		<u>i i i</u>										CLAS	SS III				
			S			Lease Na	m e			_		Well Numl	er				
	CASING AND TUBING RECORD AFTER PLUGGING METHOD OF EMPLACEMENT OF CEMENT PLUGS																
SIZ	_	WT (LB/FT)	TO BE PUT IN	WELL (FT)	_	LEFT IN W	T IN WELL (FT) HOLE SIZE The Balance Method										
7-5/	8	26.4	0-20		20			#	11.5"	4		Dump Baile					
⊨	#							#		╣		Two-Plug N	lethod				
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		CEMENTING	TO PLUG AND	ABANDON D	ATA:		PLUG #1 PLUG #2 PLUG #3 PLUG #4 PLUG #5 PLUG #6 P								PLUG #7		
Size	of Ho	ole or Pipe in v	which Plug Wil	I Be Placed ((inche		7-5/8"			╗							
Dept	h to E	Bottom of Tub	ing or Drill Pip	e (ft			20										
_			Used (each plu	ıg)			4										
_	_	lume To Be Pu					5		-	4							
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-			laterial (Class	III)			Class	A									
		LIS	T ALL OPEN H	OLE AND/OR	PERFOR	ATED INTE			INTERVAL	.s \	WHERE CAS	ING WILL BE	VARIED (if a	ny)			
		From			То						From			То			
\vdash								H		_							
Estin	ated	l Cost to Plug	Wells					_		_							
	000																
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			penalty of lav			ly examine	d and ar	n fa	miliar with								
	attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32)																
Name	and	Official Title	(Piease type o	r print)		Sign	nature							Date Signed			
Ken	Tame and Official Title (Please type or print) Signature Kenneth K. Humphreys, Chief Executive Officer Kull K. Humphreys Date Signed 03/03/2014											dueys		03/03/2014			

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	d States E				Agency							
≎EPA PLUGGIN		shington			IENT PL	AN						
Name and Address of Facility			Name a	and Add	ress of Owne	r/Operator						
Well TM2, FutureGen 2.0, Morgan County, IL				eGen A								
			73 C	entral I	ark Plaza East, Jacksonville, IL 62650							
Locate Well and Outline Unit on	State							Number				
Section Plat - 640 Acres	Illinois				Morgan							
N	Surface L		_	_								
	$\frac{SW}{M}$ 1/4 of $\frac{SW}{M}$											
┃ ┝-┽━┝-┽━┣-┽━┝-┽━┃ ┃	Locate w	Locate well in two directions from nearest lines of quarter section and drilling unit										
┃ ├ ╶╁╼┝╾┽╼┠╾╅╼┝╾┽╼┃ ┃	Surface	Surface										
	Location	ft. f	rm (N/S)L	ine of quarter	section						
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┃ <u>┝</u> ┽╼┝╌┽╼┠╌┽╼┝╌┽╼┃ ┃	Number	of Wells	1			П	ydrocarbon	Storage				
						CLAS	SS III					
s	Lease Name					Well Numb	per					
CASING AND TUBING RECORD AFTER	PLUGGING				METHOD OF EMPLACEMENT OF CEMENT PLUGS							
SIZE WT (LB/FT) TO BE PUT IN WELL (FT) TO BE	LEFT IN W	ELL (FT)	Тног	E SIZE	┨ ┌┐┰╖	e Balance Me	thad					
7-5/8 26.4 0-20 20			11.5	"	1 =	The Dump Bailer Method						
					_	e Two-Plug M						
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CEMENTING TO PLUG AND ABANDON DATA:		PLUG		LUG #2	PLUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #7			
Size of Hole or Pipe in which Plug Will Be Placed (inche Depth to Bottom of Tubing or Drill Pipe (ft		7-5/8"	-									
Sacks of Cement To Be Used (each plug)		20	-		1							
Slurry Volume To Be Pumped (cu. ft.)		5	_									
Calculated Top of Plug (ft.)		0										
Measured Top of Plug (if tagged ft.)		0										
Slurry Wt. (Lb./Gal.)		15.6										
Type Cement or Other Material (Class III)		Class										
LIST ALL OPEN HOLE AND/OR PERFOR. From To	ATED INTE	RVALS	AND INT	ERVALS	From	ING WILL BE	VARIED (if a	ny) To				
Prolii 16					ri olil			10				
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Estimated Cost to Plug Wells												
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certify under the penalty of law that I have personally	I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all											
attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the												
information is true, accurate, and complete. I am awa possiblity of fine and imprisonment. (Ref. 40 CFR 14		ere are s	ignitica	nt pena	iues for subm	nicing false li	mormation,	riciuaing the	•			
Name and Official Title <i>(Please type or print</i>)	Siar	nature					Т	Date Signed	ı			
Kenneth K. Humphreys, Chief Executive Officer			.4	1	Hung	due-	.	03/03/2014				
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TETA BUILDON		nvironm e shington		Protection A 20460	Agency								
PLUGGIN		-			ENT PL	AN							
Name and Address of Facility			Nam	e and Addre	ess of Owner	Operator (
Well TM3, FutureGen 2.0, Morgan County, IL				ureGen All Central Pa		st, Jackson	ville, IL 626	50					
Landa Wall and Outline to the	State	County Permit					Number						
Locate Well and Outline Unit on Section Plat - 640 Acres	Illinois			M	organ								
	Surface L	ocation I	Desc	riptior									
<u> </u>	ne 1/4 o	1/4 of Se 1/4 of ne 1/4 of nw 1/4 of Section 25 Township 16n Range 9w											
┃ ├-┴-├-┴ ╭┼ -├-┴-│ 「	Locate we	ocate well in two directions from nearest lines of quarter section and drilling unit											
	Surface												
╻ ┌╶┬─┌─┬─ ┌── ──│	Location	ft. f	rm (N	l/S)Lin	ne of quarter	section							
╻ ╶┝┽╼┾┽╼┣┽╼┾┽╼╿	and1	ft. from (E/W)	Line o	of quarter se	ction.							
▋ѡ ┝╅┪┪ ┇				HORIZATION	N			CTIVITY					
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▍▕ ▃共▃┞╌┼▃ ┠ ╌╀▃┞╌┼▃│ │	Number	of Wells	1				Enhanced Re Hydrocarbon						
							SS III	o totage					
S													
	Lease Nan					Well Num							
CASING AND TUBING RECORD AFTER					METH	DD OF EMP	ACEMENT O	FCEMENTPL	_UGS				
, , ,	LEFT IN WI	ELL (FT)	-	OLE SIZE	The	Balance M	ethod						
7-5/8 26.4 0-20 20			111	1.5"	The	Dump Bail	er Method						
			1			Two-Plug I	/lethod						
			╬		<u>√</u> Oth	er							
CEMENTING TO PLUG AND ABANDON DATA:		PLUG #	# T	PLUG #2	PLUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #7				
Size of Hole or Pipe in which Plug Will Be Placed (inche		7-5/8"					1 200 %5	1 2 0 8 8	1206#/				
Depth to Bottom of Tubing or Drill Pipe (ft		20	7										
Sacks of Cement To Be Used (each plug)		4											
Slurry Volume To Be Pumped (cu. ft.)		5											
Calculated Top of Plug (ft.)		0											
Measured Top of Plug (if tagged ft.)		0											
Slurry Wt. (Lb./Gal.) Type Cement or Other Material (Class III)		15.6	4										
· · · · · · · · · · · · · · · · · · ·	A TED INTE	Class A		NTEDYAL C	WHERE AAA	No wer t	MARIER #5						
LIST ALL OPEN HOLE AND/OR PERFOR. From To	A LED IN LE	RVALS A	ן עווי		From	ING WILL BI	VARIED (IT	To					
110		_											
Estimated Cost to Plug Wells													
_	\$2,000												
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\$2,000	y examined	d and am	fam	iliar with the									
\$2,000	y examined ndividuals	d and am immedia	fam itely	iliar with the responsible	for obtainir	g the infon	nation, I beli	eve that the	è				
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				Unite				al Protectio	n A	gency					
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Name ar	d Address of Fa	acility					Na	me and Ad	idre	ss of Owner	/Operator				
Well N	IS4, FutureGe	n 2.0, Morgan	n County, I	L			Fı	utureGen .	All	ance					
							7			ark Plaza East, Jacksonville, IL 62650					
Lo	cate Well and O	utline Unit on			State Illinois					County Morgan			Permit Number		
Sec	ction Plat - 640 A	cres			_		_		IVI	organ					
ı		N			Surface L					_	2.1			0	
I [1 1 1				SW 1/4 of SE 1/4 of SW 1/4 of SE 1/4 of Section 34 Township 16n Range 9W										
I ⊢		╼┠╾┽╼┞	-+-1		Locate well in two directions from nearest lines of quarter section and drilling unit										
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	1 1 1	1 1 1	- i I		Location	ft. 1	frm	(N/S)	Lin	e of quarter	section				
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I –		5 🛡													
					Lease Na	me			_		Well Numi	er			
CASING AND TUBING RECORD AFTER PLUGGING METHOD OF EMPLACEMENT OF CEMENT PLUGS															
SIZE	WT (LB/FT)	TO BE PUT IN	WELL (FT)	TO BE	LEFT IN W	ELL (FT)	-	HOLE SIZE	E	The Balance Method					
7-5/8	26.4	0-20		20				11.5"		The	Dump Baile	r Method			
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				-			#		4	✓ Oth	ier				
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Cino of I	CEMENTING Hole or Pipe in V	TO PLUG AND				7-5/8"		PLUG #2	4	PLUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #7	
	Bottom of Tub			(inche		20	_		4						
_	Cement To Be					4			┪						
Slurry V	olume To Be Pu	ımped (cu. ft.)				5			╗						
Calculat	ed Top of Plug	(ft.)				0									
	d Top of Plug (i	f tagged ft.)				0									
_	ft. (Lb./Gal.)					15.6			4						
Туре Се	ment or Other M					Class									
<u> </u>	LIS From	T ALL OPEN H	OLE AND/O	R PERFOR	ATED INTE	RVALS.	AND	INTERVAL		WHERE CAS From	ING WILL BE	VARIED (if a	ny) To		
_	From			10						From			10		
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Estimate	ed Cost to Plug	Wells													
\$2,000)														
L															
						Certifi	cat	ion							
ı															
	I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the														
in	information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32)														
				40 CFR 1	44.32)										
	nd Official Title				Sigi	nature			,	./	,	T	Date Signed		
Kennet	h K. Humphre	ys, Chief Exe	cutive Offi	icer		Ku	u	H K	.,	Hury	Lucys		03/03/2014	1	
	Kenneth K. Humphreys, Chief Executive Officer Knell K Hunghreys 03/03/2014														

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		1 2.0, Morgai	a County, IL					ıtureGen									
									Pa:	rk Plaza Ea	st, Jackson	ville, IL 626					
	Well and O	utline Unit on cres			State Illinois					organ		Permit	Number				
		N			Surface L	.oc ation	Des	criptior									
I ┌──		<u> </u>			SW 1/4 c	SW 1/4 of SW 1/4 of SW 1/4 of SE 1/4 of Section 26 Township $16n$ Range $9w$											
┃┝╬	- <u> -</u>	-	-+-		Locate well in two directions from nearest lines of quarter section and drilling unit												
<u> </u>	- <u>-</u> -	-	-+-		Location	m.	frm (N/S)	Lin	e of quarter	section						
I ⊢∔.	_Ļ-	- -	-+-1			ft. from				f quarter se							
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▮ ⊢⊹·		╌┠╌┼╌┞	-+-		A rea	a Permit					CLA	SS II					
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1		1 1 1	1 1		Numbo	r of Well	. 1				E	nhanced Re	covery				
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CASING AND TUBING RECORD AFTER PLUGGING METHOD OF EMPLACEMENT OF CEMENT PLUGS													HCS				
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		Used (each plu				4			-1								
		mped (cu. ft.)	<u> </u>			5											
Calculated T	op of Plug (ft.)				0											
Measured To	p of Plug (if	tagged ft.)				0											
Slurry Wt. (L	.b./Gal.)					15.6			\Box								
Type Cement	t or Other M	aterial (Class	III)			Class	A										
	LIST	T ALL OPEN H	OLE AND/OR	PERFOR	ATED INTE	RVALS	AND	INTERVA	LS \	WHERE CAS	ING WILL BE	VARIED (if a	ıny)				
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Name and Of	fficial Title	(Please type o	r print)		Sign	nature			-		,		Date Signed				
Kenneth K.	. Humphre	ys, Chief Exe	cutive Offic	er		Kin	u	H 7	2	Hury	duey	<	03/03/2014				