AREA OF REVIEW AND CORRECTIVE ACTION PLAN
40 CFR 146.84(b)

ONE EARTH CCS

Facility Information

Facility name: One Earth Sequestration LLC
Injection Wells: OES #1, OES #2, OES #3
Facility contact: Mark Ditsworth, VP of Technology and Special Projects
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Well location: McLean County, IL
OES #1: 40.485183°N, -88.481202°W (NAD 1983)
OES #2: 40.500444°N, -88.471786°W (NAD 1983)
OES #3: 40.515989°N, -88.479214°W (NAD 1983)

Computational Modeling Approach

Model Background

The Illinois State Geological Survey (ISGS) developed the model (named TRiINJ) using Petrel and Nexus software. The purpose of the model is to predict the CO_2 plume and pressure fronts to define the Area of Review (AoR).

The computational modeling is based on porous media theory (Darcy's Law). The CO_2 properties are based on the Peng-Robinson equation of state (Peng, D. Y. and D. B. Robinson, 1976). The process modeled is brine and CO_2 (gas and liquid) using relative permeability, including residual trapping. The geocellular model includes permeability variations that affect the multifluid flow process influencing the CO_2 plume and pressure front.

Site Geology and Hydrology

The CLASS VI NARRATIVE document describes the site geological and hydrogeological characteristics. The One Earth Energy #1 (OEE #1) site-specific data available for geology and hydrology properties used in the computational model are core, core porosity and permeability, and well log porosity and permeability.

The Eau Claire Formation (primary confining unit), the Mt. Simon Sandstone, and the Argenta are included in the models.

Injection Zone

The Mt. Simon Sandstone is the injection zone. In OEE #1, the Mt. Simon Sandstone occurs at approximately 4,455 ft (1,358 m) measured depth (MD) and has a thickness of 2,014 ft (614 m). At or near the base of the lower Mt. Simon is an arkose interval which generally has good to excellent porosity and permeability (p&p). Regionally, the lower and upper Mt. Simon have good to excellent p&p and the middle Mt. Simon has poor p&p. Below the lower Mt. Simon Sandstone is the informally named Argenta sandstone, which is generally very low p&p. At OEE #1, the Argenta occurs at 6,469 ft (1,972 m) MD and has a thickness of 449 ft (137 m).

The upper Mt. Simon is composed of fine- to coarse-grained quartz sandstones, interbedded with massive to finely planar laminated feldspar sandstones. At OEE #1, the upper Mt. Simon is about 767 ft (233 m) thick with a range of 5 to 20% porosity. Core permeability ranges from less than 2 to 830 mD and averages around 217 mD.

In OEE #1, the arkose interval occurs at 6,262 ft MD (1,909 m) and is 207 ft (63m) thick. Core porosity ranges from 1.7 to 23.8% and averages 15%. Core permeability ranges between 0.001 to over 1,900 mD with an average of 324 mD.

About 14 miles (23 kilometers) south of OEE #1 is the closest Mt. Simon well, Hinton #7, which has 215 ft (66 m) of the arkose interval with p&p up to 25% and 600 mD. At the Illinois Industrial Carbon Capture and Storage (IL-ICCS) project near Decatur, Illinois, about 50 miles from the OEE #1 well, the lower Mt. Simon has p&p up to 27% and 400 mD. At IL-ICCS and IBDP, the injection wells are perforated in the arkose interval.

The depositional environment of the Mt. Simon Sandstone and similarity in rock characteristics areally demonstrate the lateral continuity of the Mt. Simon over a large region of central Illinois (Figure 1). (See REGIONAL GEOLOGY document.) The arkose interval is present in each of the wells across a multi-county area (Figure 2).

In OEE #1, the Mt. Simon Sandstone water salinity is 166,000 mg/L (ppm), which is consistent with regional mapping of salinity data for the Mt. Simon Sandstone in the Illinois Basin.

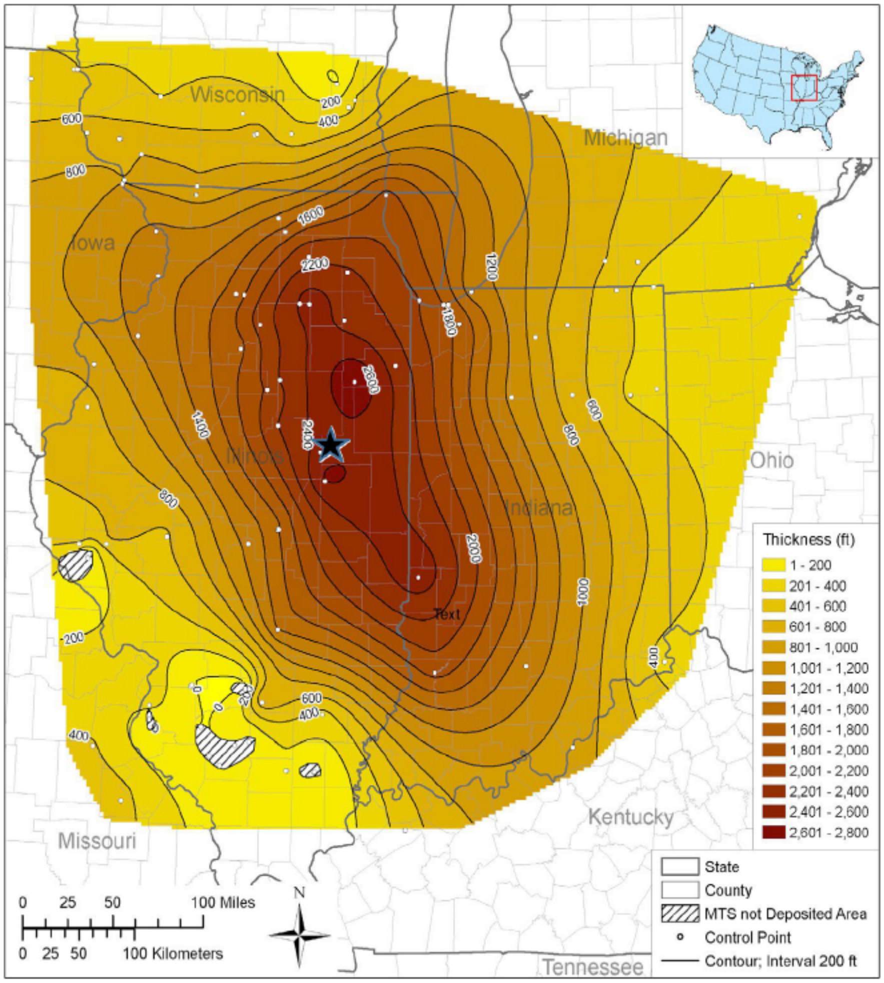

Figure 1. *Isopach map of Mt. Simon Sandstone and Argenta sandstone thickness. Black star identifies OEE #1. The map corner coordinates (Decimal Degree NAD83) are NE: -82.340550, 43.842385; SE: -82.824731, 36.384301; SW: -91.527664, 36.371440; NW: -92.052323, 43.825652.*

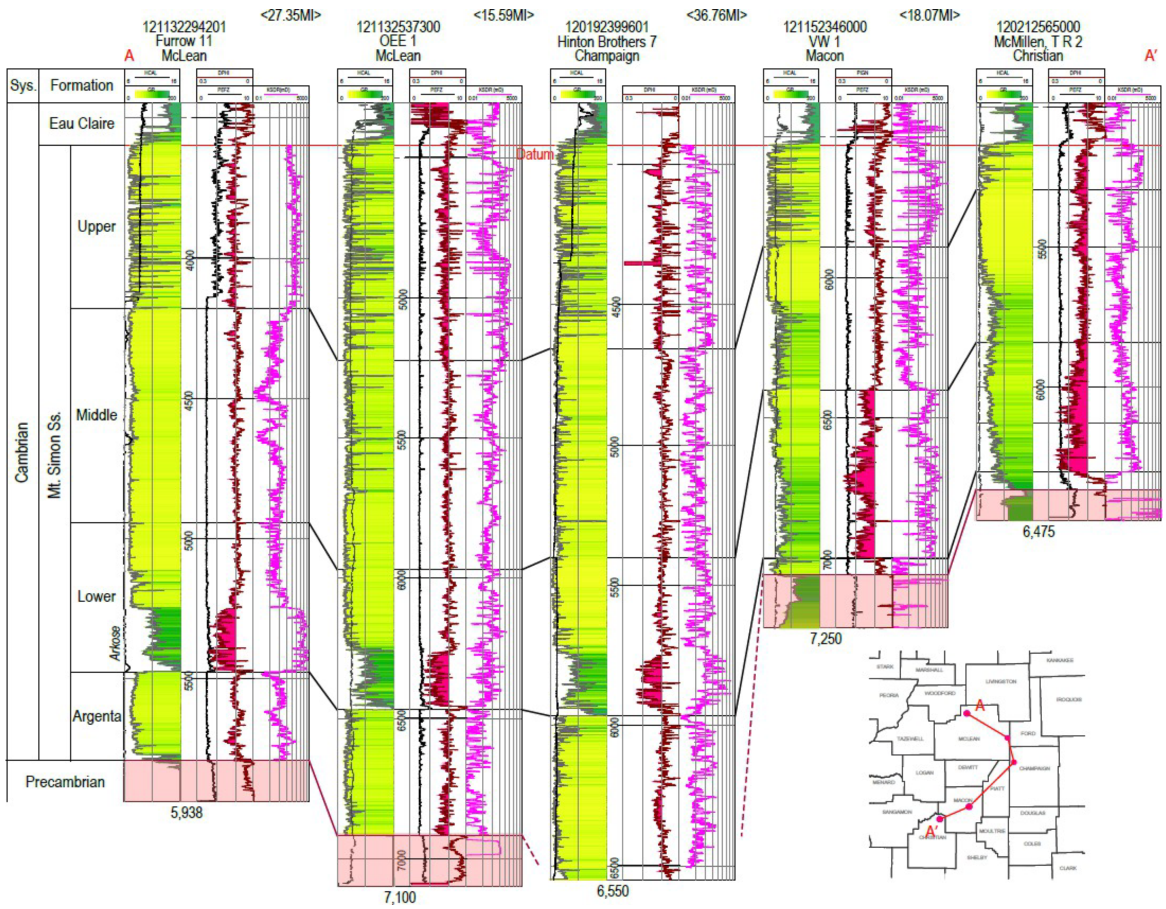

Figure 2. Stratigraphic cross-section of the Mt. Simon (lower right inset). The pink highlighted section is the Precambrian surface. Datum: base of Eau Claire. The coordinates (Decimal Degree NAD83) of the northernmost well are -88.918922, 40.683164, and the coordinates of the southernmost well are -89.203412, 39.772784.

Confining Zones

The Eau Claire Formation is a confining layer primarily composed of clay-rich shale. It underlies the entire state of Illinois with a thickness that varies from less than 300 feet (91 meters) to over 1,000 feet (305 meters) (Buschbach, 1964).

At the OEE #1 site, the Eau Claire Formation has a thickness of 534 feet (163 meters) and directly overlies the Mt. Simon Sandstone.

Model Domain

Schlumberger's Petrel (version 2021) was used to create a static geocellular model that includes the structure and petrophysical properties of the injection zone and confining zone. Landmark's Nexus (version 5000.4.14) was used to refine cells in the center of the model and simulate CO_2 injection.

The model is 20 × 20 miles (32 × 32 kilometers) laterally, with an average thickness of 2,977 ft (907 m). The model has 106 ×106 × 143 cells, each cell is 1,000 × 1,000 ft (305 × 305 m) areally; the cell thickness varied from 2.5 ft to 179 ft (0.76 m to 54.6 m), averaging 21 ft (6.4 m). Local grid refinement was applied to an 8 × 8-mile (12.9 × 12.9 kilometers) area, including all project wells. Each 1000 x 1000 ft (305 x 305 m) cell was refined into 4 250 × 250 ft (76 x 76 m) cells.

Model domain information is summarized in Table 1.

Table 1. *Model domain information*

Coordinate System	NAD 27 Illinois State Plane, Eastern Zone, US Foot (SPCS27 1201)		
Horizontal Datum	North American Datum of 1927		
Coordinate System Units	US Foot		
Zone	Illinois East		
FIPSZONE	1201	**ADSZONE**	-
Coordinate of X min	408000	**Coordinate of X max**	-
Coordinate of Y min	1339500	**Coordinate of Y max**	-
Elevation of the bottom of the domain	-6,548 (ft)	**Elevation of the bottom of the domain**	-

Porosity and Permeability

The OEE #1 (i.e. site-specific) data used to determine p&p includes laboratory core measurements and geophysical logs (neutron porosity, nuclear magnetic resonance logs, and resistivity logs). Data from two additional wells in the model domain was used: Hinton Brothers #7 (core p&p, and logs) and Furrow #11 (logs). The range of porosity and permeability observed at the OEE #1 was similar to that of the Furrow #11 and the Hinton Brothers #7.

Neutron porosity logs provided the best calibration to core porosity. A permeability log was created from the core-calibrated porosity log calibrated to core permeability. The permeability log for OEE #1 used the NMR log and the Schlumberger Doll Research method. The permeability log for the Hinton Brothers #7 and Furrow #11 wells used each well's porosity and resistivity logs.

The Eau Claire is described as constant porosity (4.5%) and permeability (0.0001 md).

Within the injection zone at OEE #1, the core spatial distribution vertically varies between ~0.5 ft to ~30 ft (~0.15 m to ~ 9.1 m). Laterally, OEE #1 is 15.5 miles (24.9 kilometers) from the Hinton Brothers #7, and 27.5 miles (44.3 kilometers) from the Furrow #11 (Figure 3).

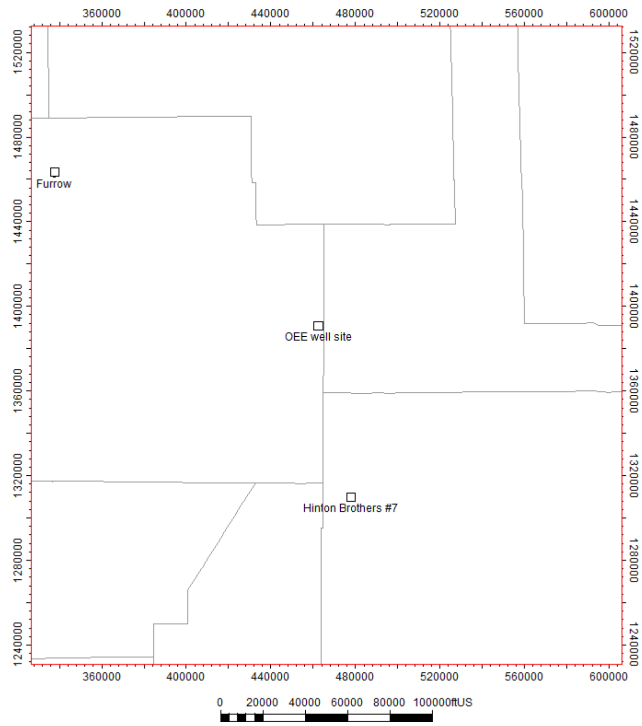

Figure 3. *This map shows the location of wells used to determine the porosity and permeability of the injection and confining zones. Coordinates in IL State Plane East NAD27 are notated on the map.*

Figure 4 and Figure 5 show porosity and permeability distributions from the three wells used to populate the static models. Within the arkose interval, the porosity range is 6-28% and the horizontal permeability range is 0.05-1,970 mD. The model's porosity (Figure 6 and Figure 7) and permeability (Figure 8 and Figure 9) were distributed using the sequential gaussian algorithm and lateral distributions consistent with the geologic conceptual model.

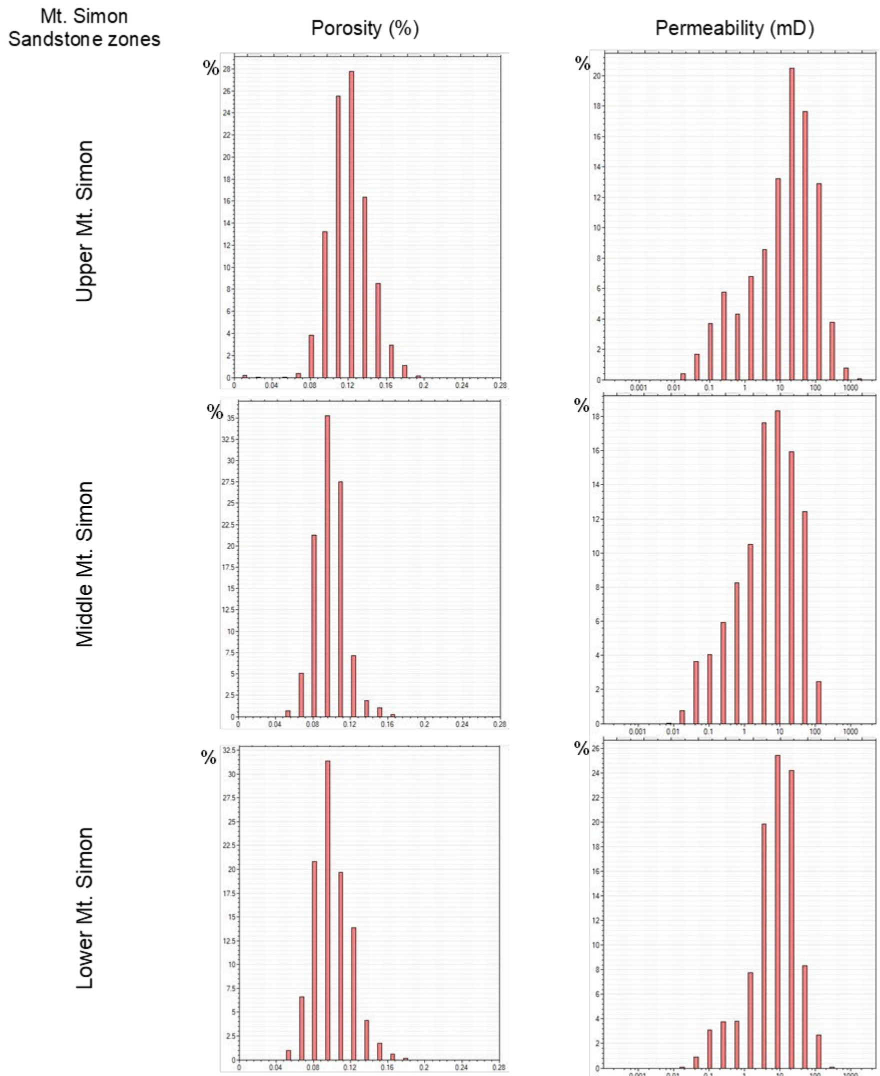

Figure 4. *Porosity and permeability distributions in the upper, middle, and lower Mt. Simon zones. Data are from the three well locations OEE #1, Hinton Brothers #7, and Furrow #11.*

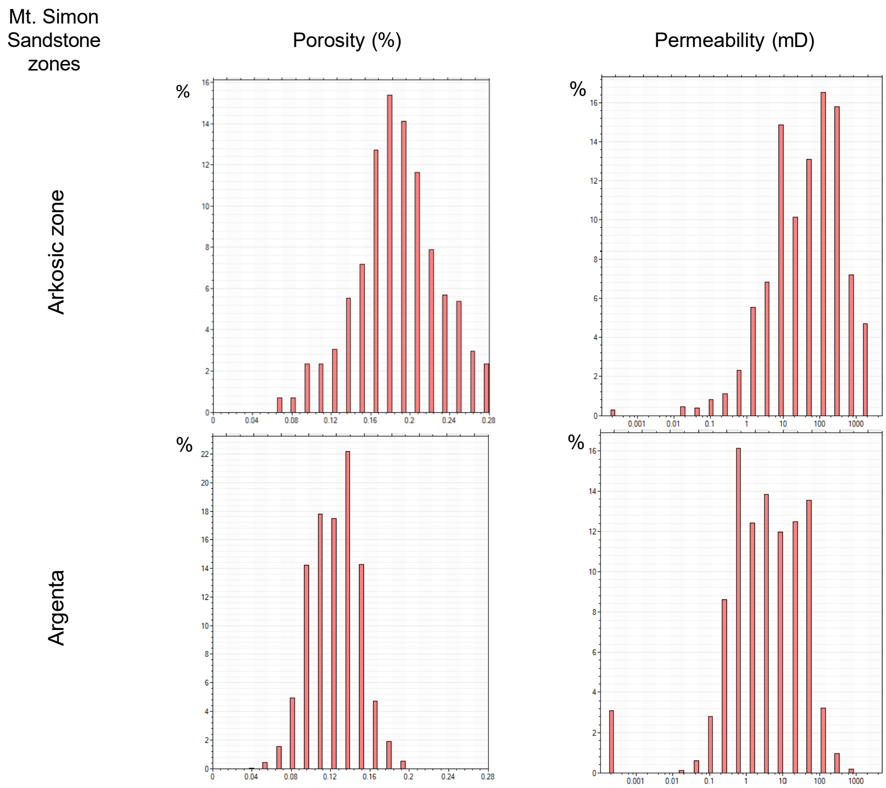

Figure 5. *Porosity and permeability distributions in the Arkose and Argenta zones. Data are from the three well locations OEE #1, Hinton Brothers #7, and Furrow #11.*

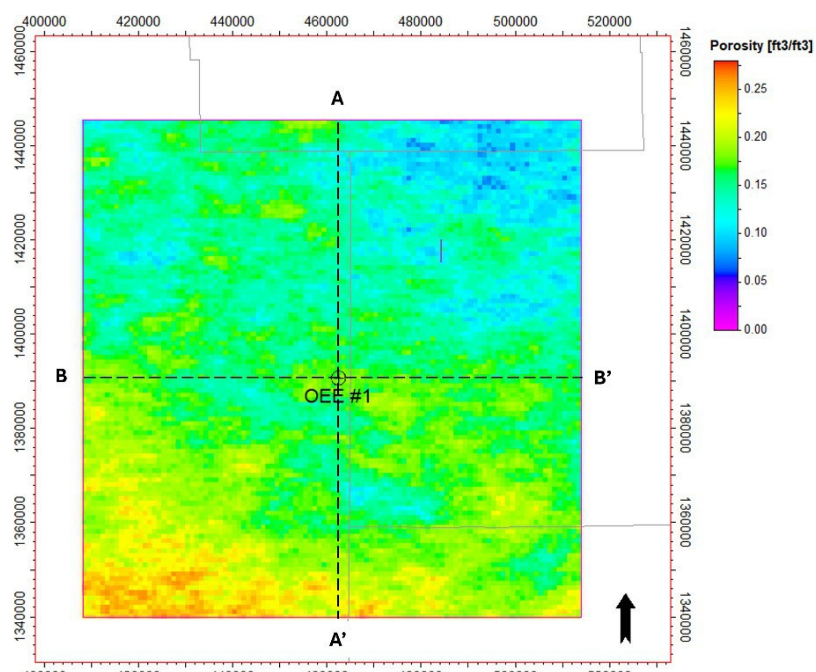

Figure 6. *The porosity of the top model layer (plan view) of the Arkose interval. The model domain (red box) corner coordinates (Decimal Degree NAD83) are approximately: NE: -88.28289, 40.635788; SE: -88.28289, 40.344361; SW: -88.66480, 40.344361; NW: -88.66480, 40.635788.*

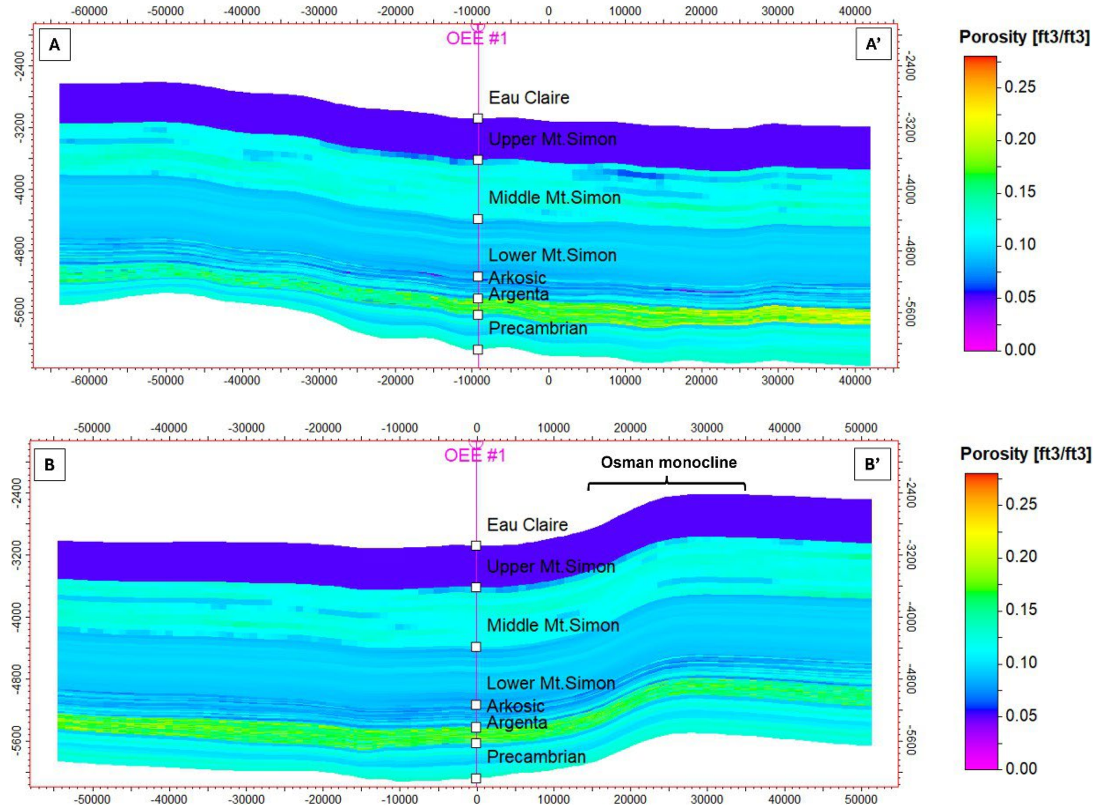

***Figure** 7. North-South (A-A') and West-East (B-B') vertical cross-section of the permeability model through OEE #1 (north to left and west to left respectively). Vertical exaggeration is ~10x.*

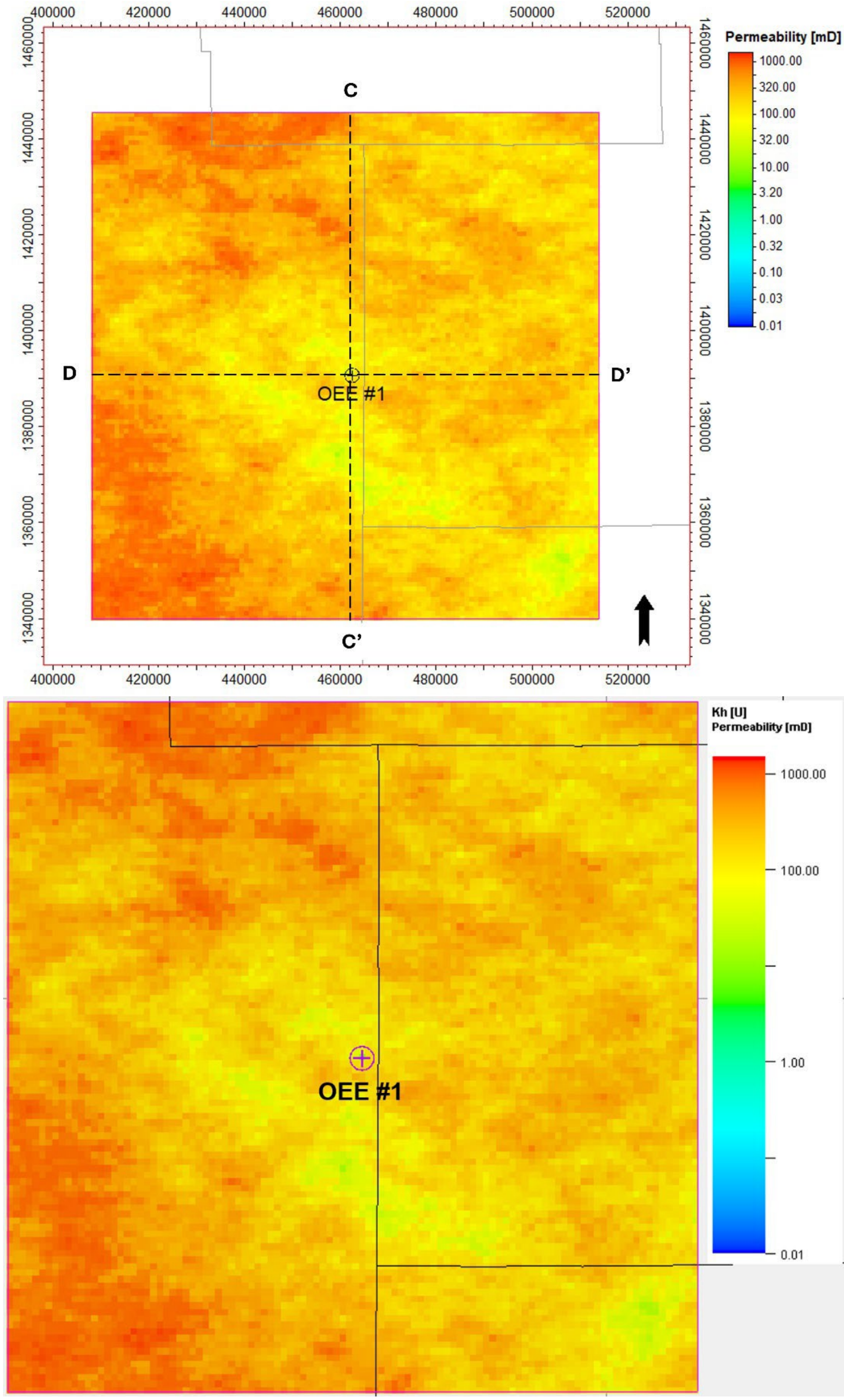

Figure 8*. Permeability of the top model layer (plan view) of the Arkose interval. The model domain (red box) corner coordinates (Decimal Degree NAD83) are approximately: NE: -88.28289, 40.635788; SE: -88.28289, 40.344361; SW: -88.66480, 40.344361; NW: -88.66480, 40.635788.*

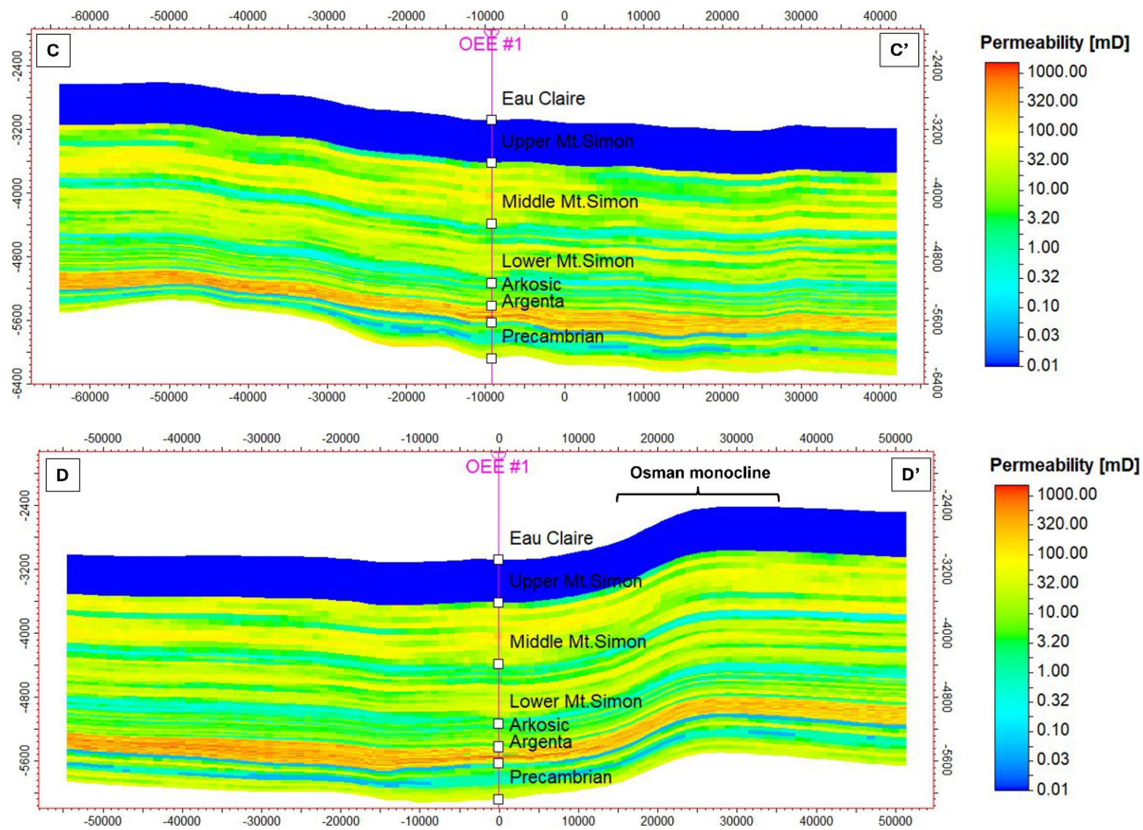

Figure 9. *North-South (C-C') and West-East (D-D') vertical cross-section of the permeability model through OEE #1 (north to left and west to left respectively). Vertical exaggeration is ~10x.*

Constitutive Relationships and Other Rock Properties

Three sets of Corey generated (Corey, 1954) relative permeability representing high- (permeability greater than 100 mD), mid- (permeability between 1 mD and 100 mD), and low-quality rock (permeability less than 1 mD) were used (Figure 10). The high-quality relative perm was based on lab measurements of lower Mt. Simon rock from the Decatur area wells. The relative permeability data of mid- and low-quality rocks were generated based on the high-quality relative permeability and the principle that irreducible water saturation increases and movable saturation range decreases as permeability decreases.

Rock compressibility (5.61×10^{-6} psi^{-1}) was estimated using Newman's correlation for sandstone (Newman, 1973) for 11.4%, the average porosity of the Mt. Simon and Argenta.

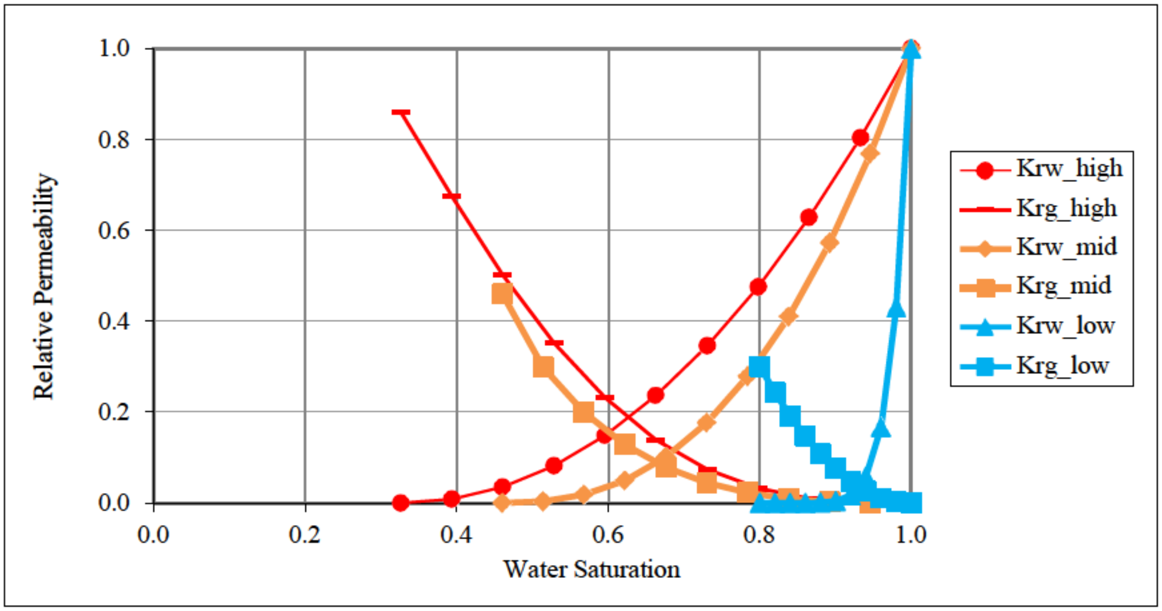

Figure 10. *Three sets of CO_2 and brine relative permeability curves used in the model.*

Boundary Conditions

The top and bottom of the model are no-flow boundaries. The four sides of Eau Claire are closed. The four sides of the Mt. Simon and Argenta are open by attaching an infinite-acting Carter-Tracy analytical aquifer.

Initial Conditions

Initial conditions for the model are given in Table 2.

Table 2. *Initial conditions.*

Parameter	**Value or Range**	**Units**	**Corresponding Elevation (ft MSL)**	**Data Source**
Temperature	120	°F	5,435	Borehole temperature log
Formation pressure	2,835	psi	5,435	IBDP reference 0.453 psi/ft
Fluid density	70.08	lb/ft^3	5,435	Calculated from salinity, pressure, and temperature (McCain, 1991)
Salinity	166,000	ppm	5,435	Brine chemistry analysis from OEE #1

Operational Information

Operating details are presented in Table 3.

Table 3. *Operating details.*

Operating Information	Injection Well 1	Injection Well 2	Injection Well 3
Location (global coordinates) X Y	(DD NAD83) -88.481202 40.485183	(DD NAD83) -88.471786 40.500444	(DD NAD83) -88.479214 40.515989
Model coordinates (ft) X Y	(IL SPE 1201 NAD27) 459215 1390740	(IL SPE 1201 N27) 460722 1396081	(IL SPE 1201 N27) 459251 1401815
No. of perforated intervals	1	1	1
Perforated interval (ft MSL) Z top Z bottom	 5,417 5,649	 5,374 5,563	 5,327 5,502
Wellbore diameter (in.)	12.25	12.25	12.25
Planned injection period Start Year End Year	 2025 2045	 2025 2045	 2025 2045
Injection duration (years)	20	20	20
Injection rate (tonne/day)	4,110	4,110	4,110

Fracture Pressure and Fracture Gradient

At the time of this modeling, OEE #1 injection testing was not completed; so, a fracture pressure gradient of 0.71 psi/ft (16.1 MPa/km) from CCS1 at Decatur, IL was used. Calculated fracture gradient and maximum injection pressure values are given in Table 4.

Table 4. *Injection pressure details.*

Injection Pressure Details	Injection Well 1	Injection Well 2	Injection Well 3
Fracture gradient (psi/ft)	0.71	0.71	0.71
Maximum injection pressure (90% of fracture pressure) (psi)	3,990	3,962	3,932
Elevation corresponding to maximum injection pressure (ft MSL)	5,417	5,374	5,327
Elevation at the top of the perforated interval (ft MSL)	5,417	5,374	5,327
Calculated maximum injection pressure at the top of the perforated interval (psi)	3,990	3,962	3,932

Computational Modeling Results

Predictions of System Behavior

The CO_2 plume was defined by a CO_2 saturation of 1%. The pressure front area is where the pressure change is greater than or equal to the critical differential pressure.

Figure 11 shows the evolution of the CO_2 plume and pressure front over time. At the end of injection, the CO_2 plume was 32 square miles (83 square kilometers), and the pressure front reached its maximum of 192 square miles (497 square kilometers). The CO_2 plume size increased from 31.9 square miles (51 square kilometers) at the end of the injection period to a maximum of 33.8 square miles (54 square kilometers) 20 years after injection ends and remained unchanged at the end of the post-injection period (50 years). The pressure front size decreased during post-injection. The areal extents of the pressure front and CO_2 plume are equivalent about 7 years after injection stops.

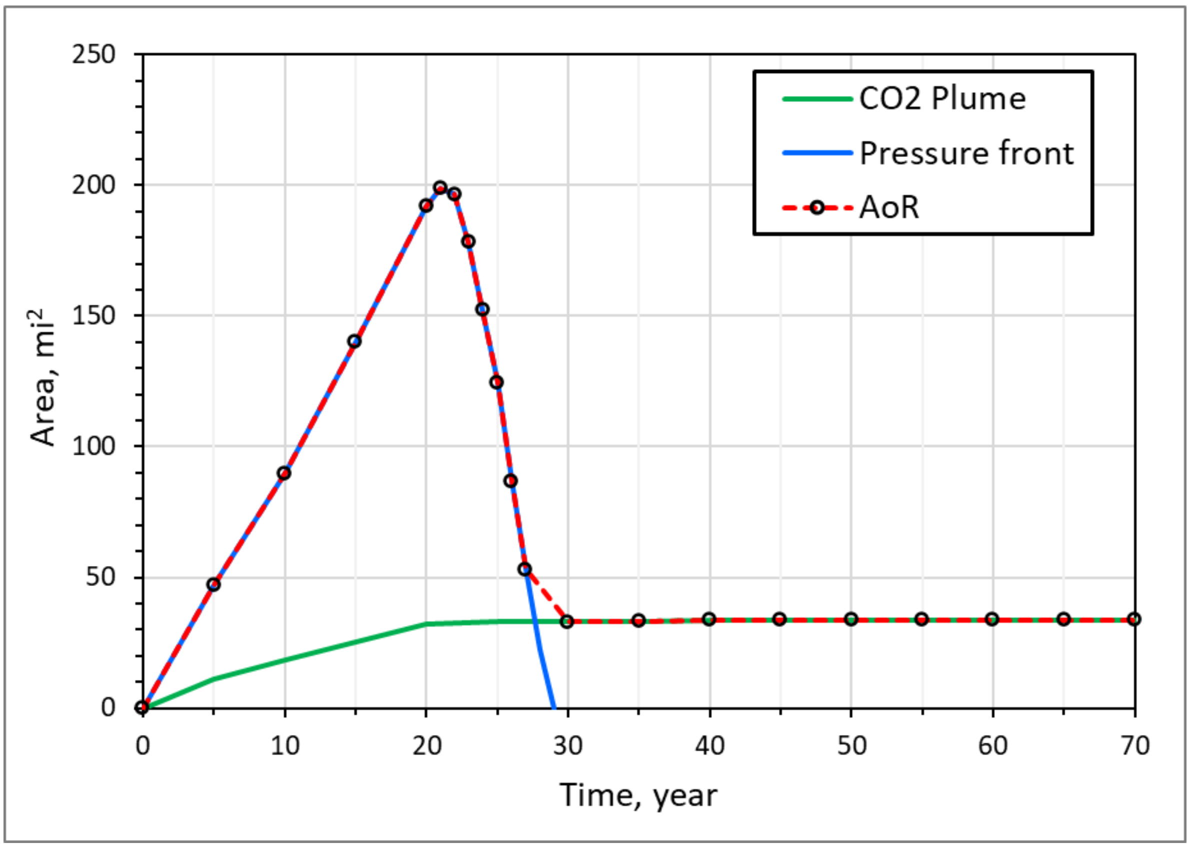

Figure 11. *Area of CO_2 plume and pressure front change with time over 20 years of injection and 50 years of post-injection modeling.*

Model Calibration and Validation

Three sets of sensitivity analysis were conducted on CO_2 plume size and pressure front: 1) injection well spacing, 2) the sensitivity of porosity and permeability, and 3) presence of conductive fault(s) near the Osman Monocline. The arkose interval is perforated according to Table 3. OES #1 was 0.6 miles (1 kilometer) away from OEE #1 to ensure CO_2 plume detection at OEE #1.

Well distance: Three well distances between the injectors were considered: 1 mile, 1.5 miles, and 2 miles (1.6, 2.4, and 3.2 kilometers). Simulation results showed that 1 mile distance resulted in the smallest CO_2 plume (34 square miles; 88 square kilometers) (Figure 12). The pressure front was the same among all three distances (Figure 13). Therefore, the distance between the three injectors (Table 3) was 1 mile (1.6 kilometers).

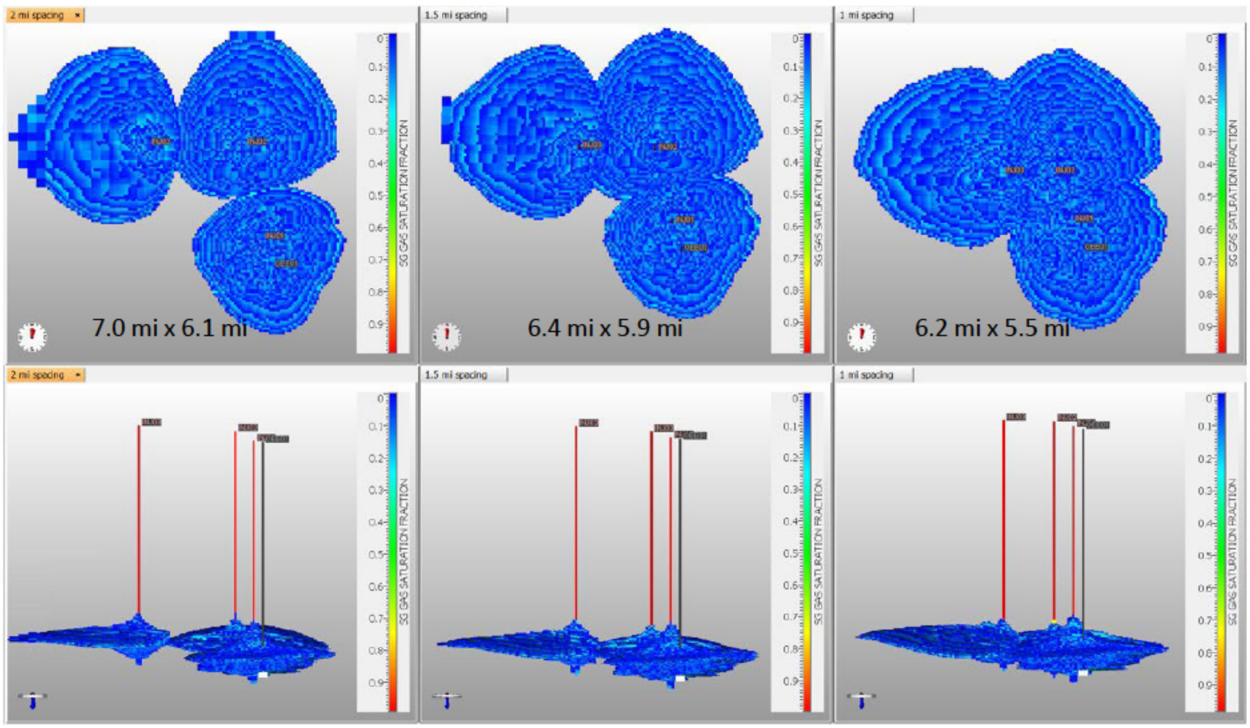

__Figure 12.__ Plan and cross-sectional views of CO_2 plume at various well distances. (Distance between wells in upper left corner of each view.) Vertical exaggeration is 10x. The model domain (gray-to-white-shaded area in plan view images) corner coordinates (Decimal Degree NAD83) are approximately: NE: -88.4091817, 40.5606236; SE: -88.4090161, 40.4486915; SW: -88.5725000, 40.4485853; NW: -88.5727664, 40.5604317.

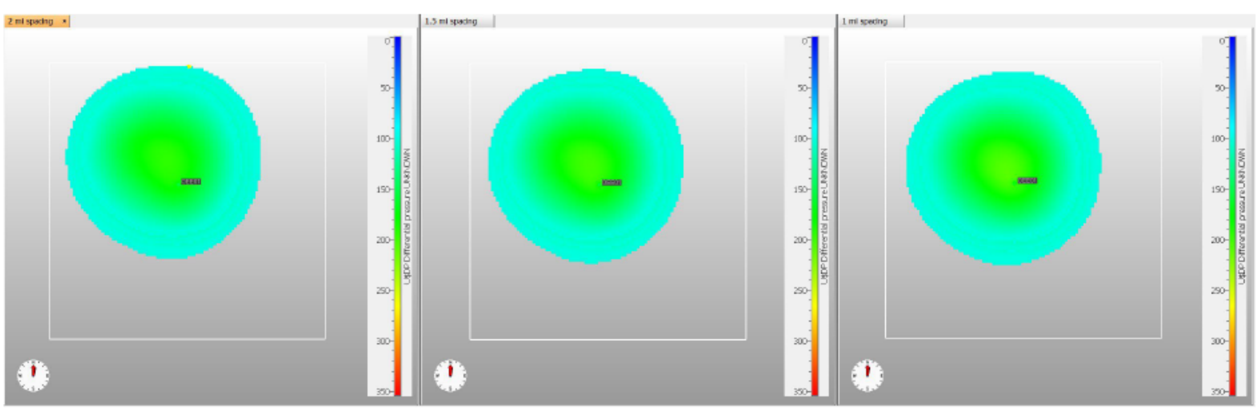

__Figure 13.__ Pressure front at the end of injection at three well distances. Distance between wells in the upper left corner of each view. OEE #1 is shown. The white square box is 20 miles by 20 miles. The model domain (gray box)

corner coordinates (Decimal Degree NAD83) are approximately: NE: -88.28289, 40.635788; SE: -88.28289, 40.344361; SW: -88.66480, 40.344361; NW: -88.66480, 40.635788.

Porosity and permeability: An 80% and 120% multiplier to the cellular porosity and permeability models showed that an increase in porosity slightly decreased CO_2 plume size but had little effect on the pressure front. Similarly, a change in permeability had little effect on CO_2 plume size and pressure front.

Figure 14 to Figure 16 show the effect of porosity and permeability on plume, pressure front, and AoR.

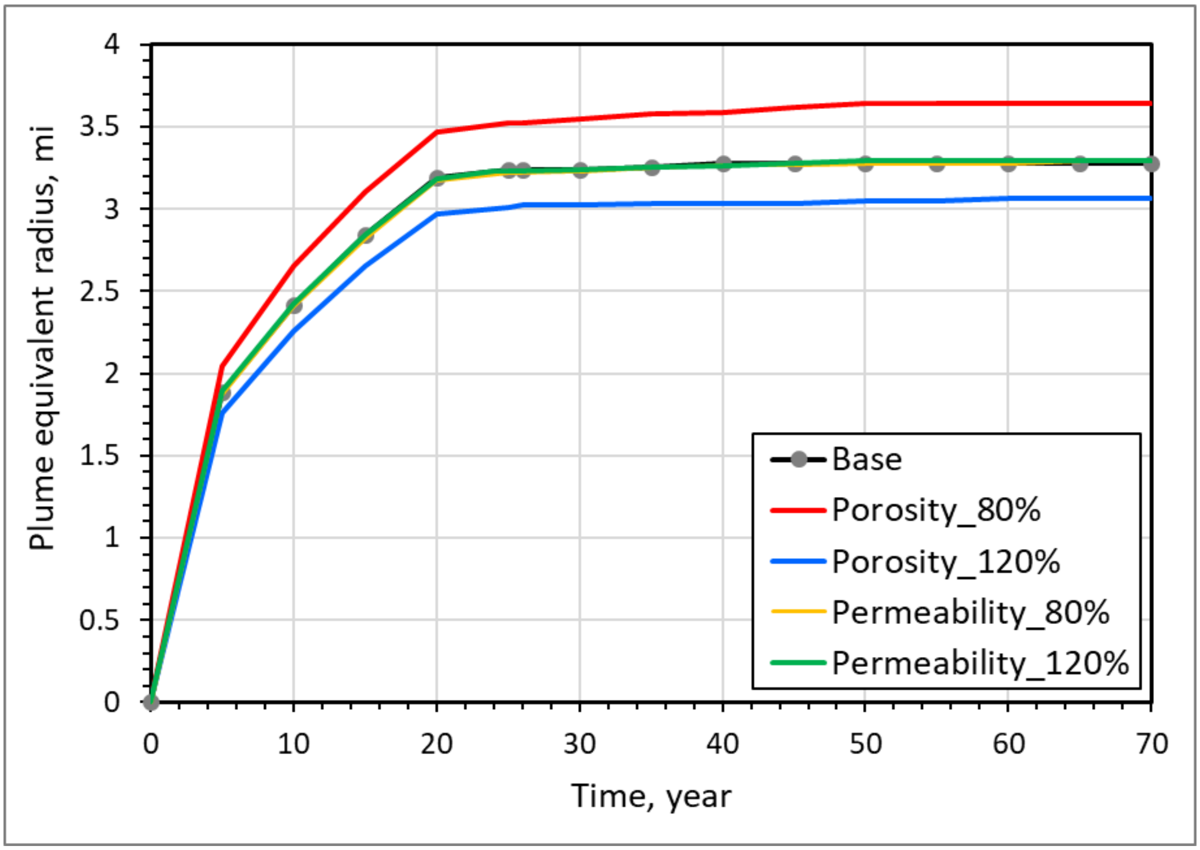

Figure 14. *Plume equivalent radius change with time at varying porosity and permeability.*

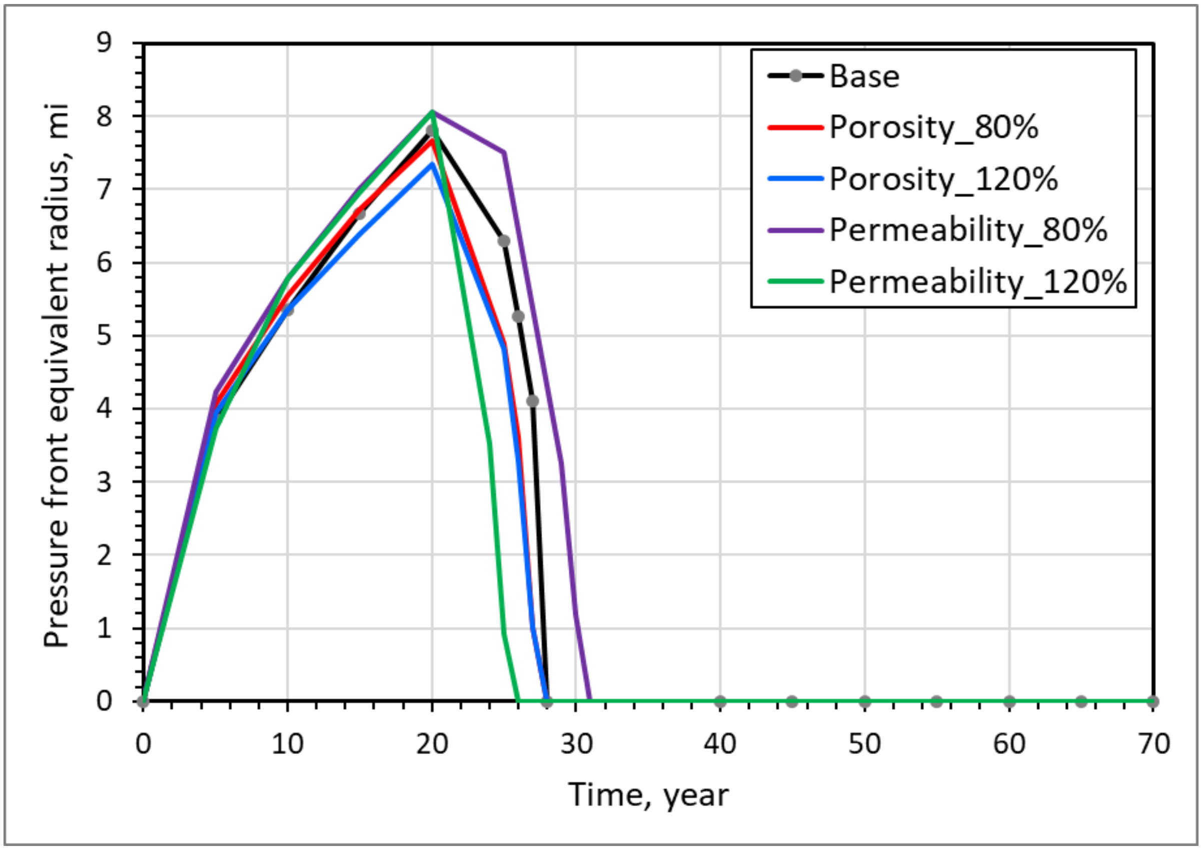

Figure 15. *Pressure fronts equivalent radius changes with time at varying porosity and permeability.*

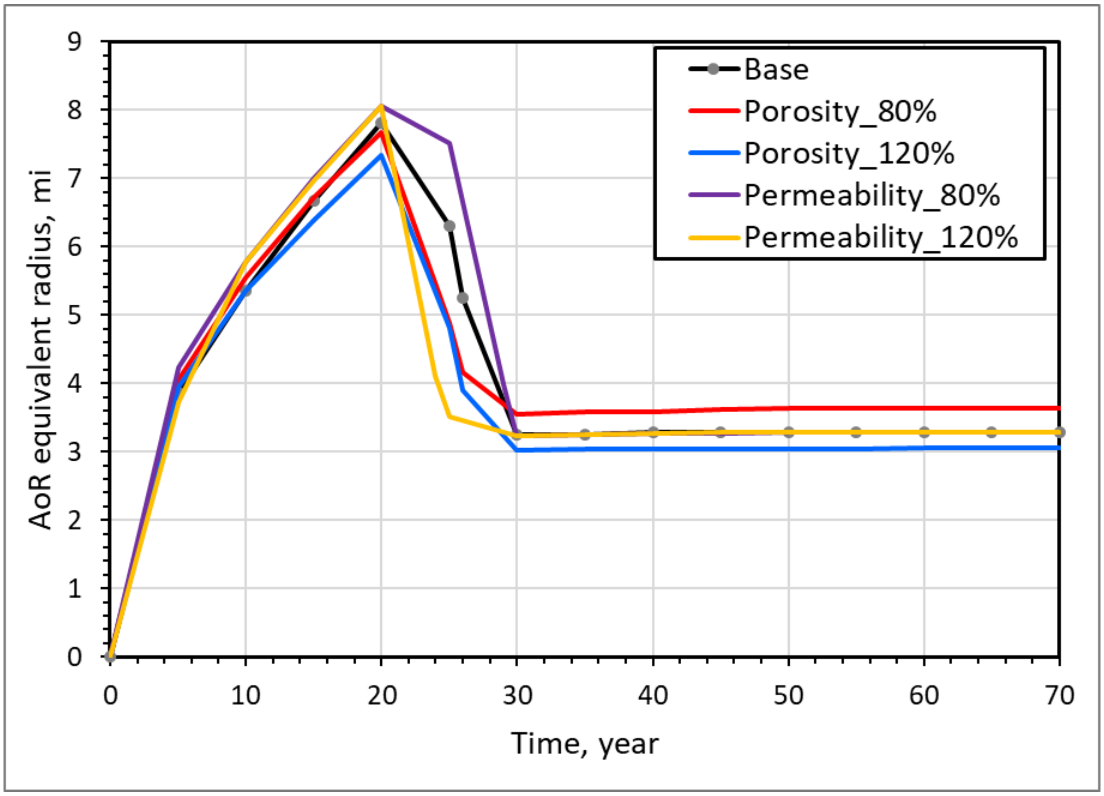

Figure 16. *AoR equivalent radius changes with time at varying porosity and permeability.*

A 20% increase in porosity led to a 7% decrease in plume radius at both 20-year injection and 50-year post-injection, and it resulted in a 3% decrease in pressure front radius at 20-year injection, thus a 3% decrease in AoR radius at 20-year injection and a 7% decrease in AoR radius at 50-year post-injection. The permeability change, however, has a negligible effect on plume size. A 20% change in permeability led to a 7% increase in pressure front radius, thus a 7% increase in AoR radius at 20-year injection. The AoR was affected more by permeability than porosity during injection and post-injection before the pressure front disappeared, and it was then affected only by porosity afterward.

In summary, CO_2 could be injected at up to 2.6 Mt/yr/well via three injectors with an injector 0.6 mile (0.97 kilometers) west of OEE #1 and two other injectors about 1 mile (1.6 kilometers) apart on the northwest side at the OEE site. When CO_2 was injected at 1.5 Mt/yr/well for 20 years, the plume size was 3.2 miles (5.15 kilometers) at the end of injection and 3.3 miles (5.3 kilometers) at 50-year post-injection, the pressure front was 2–2.4 times the plume size, and the maximum AoR was 178 mi^2 at the end of injection. A 20% change in porosity and permeability resulted in a 7% change in AoR radius.

Conductive fault(s) sensitivity: ISGS performed a fault flow analysis. Fault locations were identified at 25,750’ NE of OEE #1 and 24,050’ NE of the proposed OES #3 location. High permeability (2 Darcies) was assigned to grid cells at the fault locations. A dynamic simulation was performed in which the fault, based on 3D seismic interpretation, extended from the top of the Lower Mt. Simon Sandstone to the top of the Eau Claire Formation.

Modeling results show that the maximum pressure buildup at the top of the Eau Claire Formation is about 121.6 psi (0.84 MPa) at the end of the injection period (Figure 17, top left). However, 7 years after injection ceases, the pressure buildup at the top of Eau Claire decreases to 73.5 psi (0.51 MPa), below the critical differential pressure of 77.5 psi (0.53 MPa). Pressure buildup at the top of the Eau Claire drops from 121.6 psi (0.84 MPA) at the end of the injection period to 15.5 psi (0.11 MPa) after 50 years post-injection. The pressure front (Figure 17, left) sizes of both simulations (with and without faults) are similar. On the other hand, the CO_2 plume distribution with or without the fault remained unchanged (Figure 17, right). The presence of conductive faults near the Osman Monocline does not impact the CO_2 plume distribution within the model.

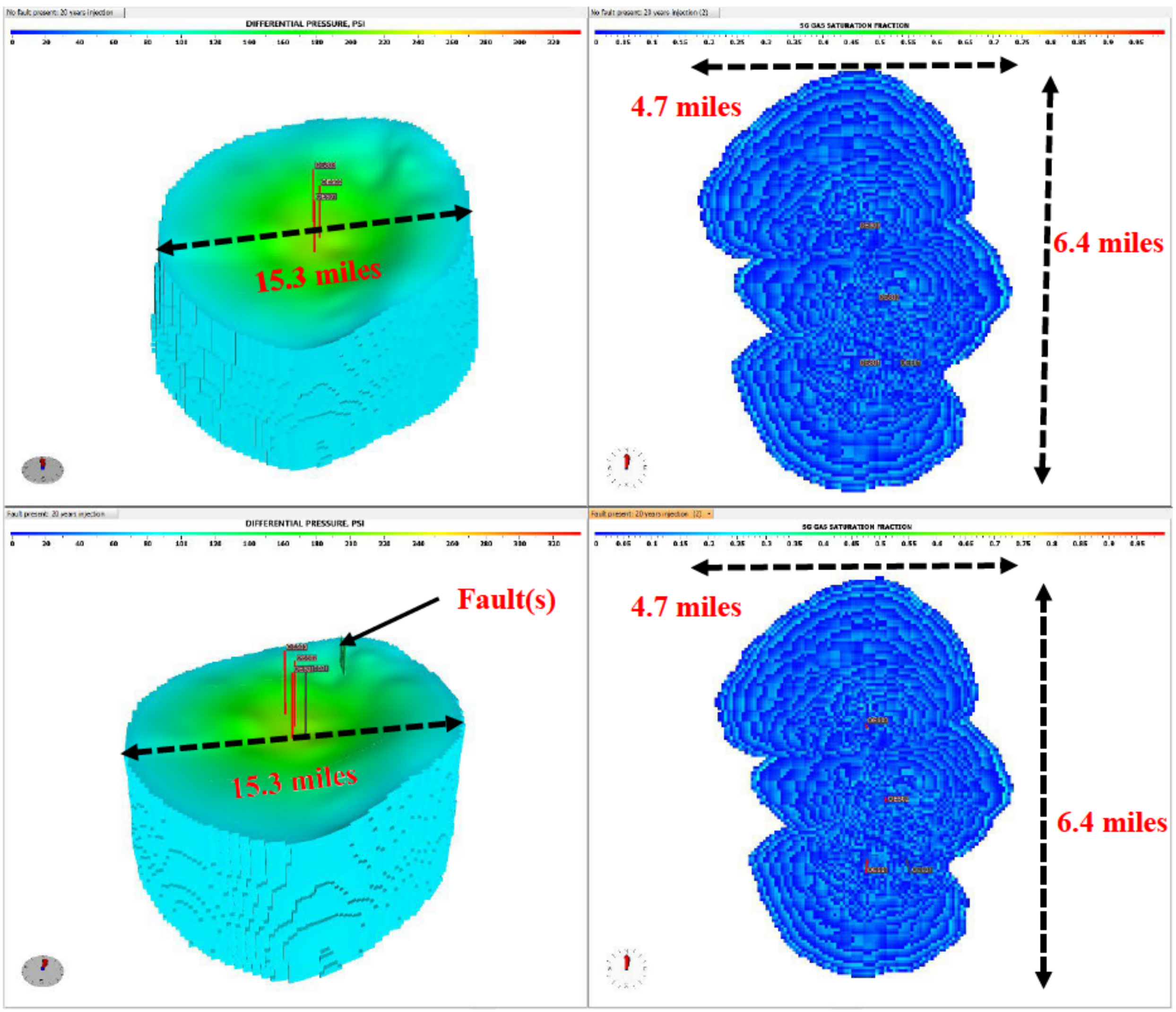

Figure 17*. Left: pressure front across the entire Mt. Simon Storage complex model (15 times vertical exaggeration) showing pressure buildup at the top of a notional leaky fault system 5 miles northeast of OEE #1 after 20 years of injection. Right: maximum CO_2 plume extent. Top: No faults are included in the model. Bottom: conductive faults included in the model. The model domain (gray box) corner coordinates (Decimal Degree NAD83) for the CO_2 plumes*

(right top and bottom figures) are approximately: NE: -88.398277, 40.559733; SE: -88.398768, 40.458107; SW: -88.553663, 40.45836; NW: -88.553674, 40.559819.

AoR Delineation

Critical Pressure Calculations

The pressure front is defined by the extent of the critical differential pressure (Δp_{crit}), the minimum pressure increase in the injection zone that initiates fluid flow from the injection zone into the deepest underground source of drinking water (USDW) through a notional conduit (White et al., 2019; Nicot et al., 2009). The approach for estimating the minimum pressure in this study assumes fluid density in the wellbore to be uniform and equal to the fluid density in the injection zone (Birkholzer et al., 2011).

Per EPA Guidance, the critical differential pressure of the Mt. Simon Sandstone was calculated for the One Earth Sequestration site using Method 1 (USEPA 2013) for under-pressured reservoirs using the following equation (Birkholzer et al., 2011):

$$\Delta pp_{cccccccc} = pp_{uu} + \rho\rho_{cc} gg(zz_{uu} - zz_{cc}) - pp_{cc} \qquad (1)$$

Site-specific data were used to calculate the critical differential pressure (Equation 1b) as follows:

$$\Delta pp_{cccccccc} = 7{,}266{,}539.25 + (1{,}061.41384)(9.807)(-490.12 - -1{,}106.1) - 13{,}144{,}170.5 \qquad (1b)$$

Table 5 defines Equation 1 variables (except for g, which is the acceleration due to gravity, 9.807 -m/s^2). At OEE #1, the lowermost USDW is the St. Peter Sandstone, and the target storage formation is the Mt. Simon Sandstone. Table 6 lists $\Delta pp_{cccccccc}$ and the parameters used in Equations 1 and 1b.

***Table 5.** Inputs used to calculate $\Delta p_{cccccccc}$ at OEE #1.*

Parameters		Value	Units	Data source
Input	Elevation of the bottom of the St. Peter Sandstone (z_u)	-1,608	ft (SS)	Formation tops observed in OEE #1 (see Table 1 in Project Narrative).
		490.12	m (SS)	
	Initial pressure at the base of the St. Peter Sandstone (p_u)	1,053.922	psi	Assumed 0.433 psi/ft freshwater pressure gradient.
		7,266,539.25	Pa	
	Elevation at the top of the Mt. Simon Sandstone (z_i)	-3,629	ft (SS)	Formation tops observed in OEE #1 (see Table 1 in Project Narrative).
		1,106.1	m (SS)	
	Initial pressure at the top of the Mt. Simon Sandstone (p_i)	1,906.4	psi	XPS pressure log run in OEE #1
		12,144,170.5	Pa	
	Fluid density within the injection zone (ρ_i)	1,061.41384	kg/m^3	Field brine sample collected from OEE #1.
		66.26	lb/ft^3	
Output	Δp_{crit}	534,497.01	Pa	Equation 1
		0.53449701	MPa	
		77.5	psi	

AoR Delineation

As indicated by EPA, "The boundaries of the AoR are based on simulated predictions of the extent of the separate-phase (i.e., supercritical, liquid, or gaseous) plume and pressure front" (USEPA, 2013). Area of Review (AoR) is the greater of either the maximum areal extent of CO_2 plume or pressure front, or a combination of the two, over the duration of a storage project. At the One Earth Sequestration site, the pressure front defined by the Δp_{crit} of 77.5 psi (0.53 MPa) was larger than the lateral extent of the CO_2 plume and therefore used to delineate the AoR. The pressure front reached maximum extent in Year 21 (or 1 year into the post-injection phase). Therefore, Δp_{crit} was applied to the simulation results from that timestep to delineate the project AoR.

Figure 18 shows the AoR, overlain on a topographic map of the area around the project wells. The AoR is based on the pressure front and is approximately 198.8 square miles (514.9 square kilometers).

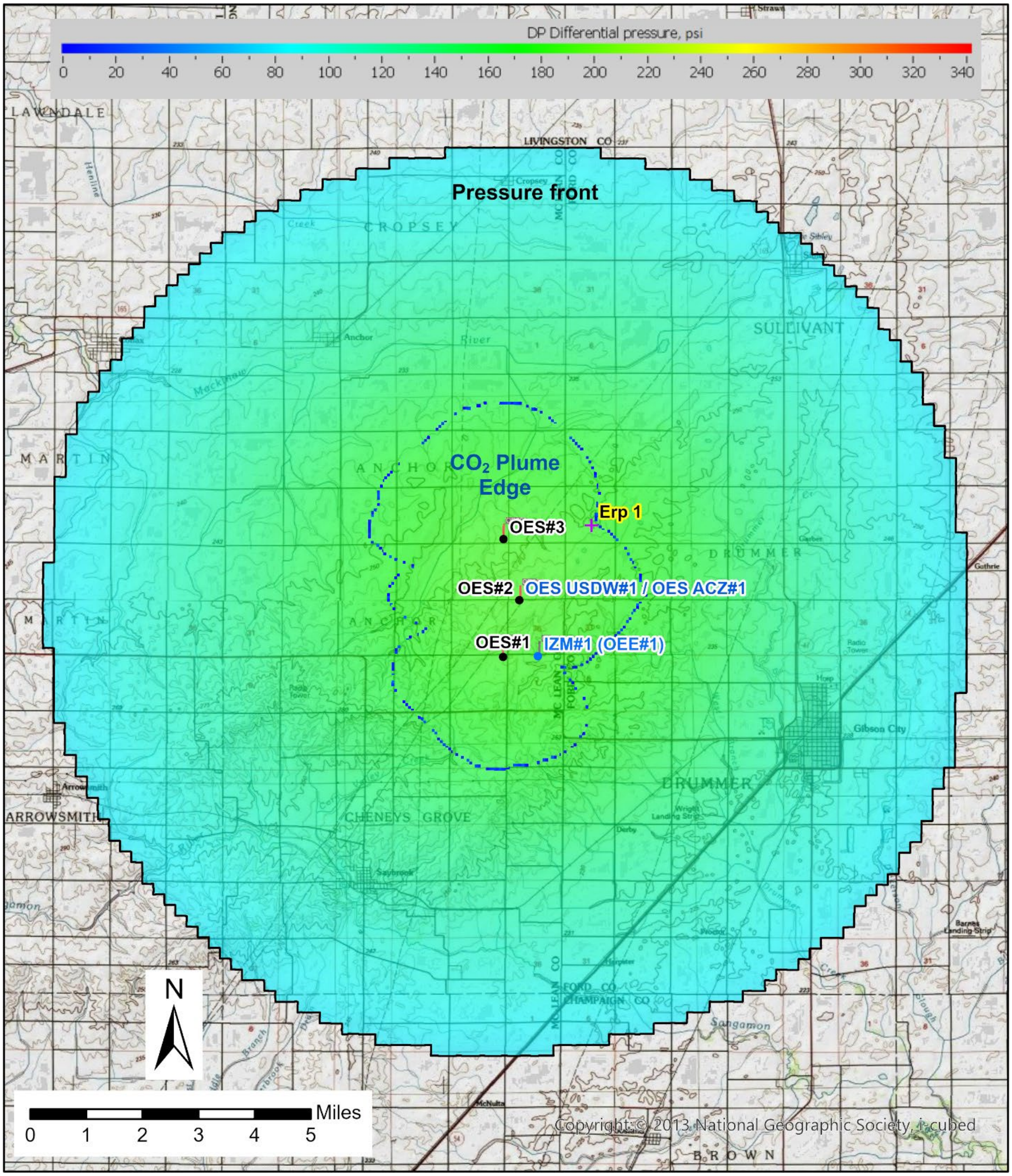

Figure 18. *Predicted Area of Review for the One Earth Sequestration project. The Area of Review reflects the maximal extent of the critical differential pressure front, defined by* Δp_{crit}, *at 21 years, one year into the post-injection phase. The map corner coordinates (Decimal Degree NAD1983) are NE: -88.309199, 40.653973; SE: -88.309307, 40.352654; SW: -88.648213, 40.352227; NW: -88.649625, 40.653543.*

Corrective Action

Tabulation of Wells within the AoR

Wells within the AoR

The ISGS Wells and Borings Database and the ISGS coal stratigraphic database were the sources of the tabulated wells. A total of 573 wells and borings are located within the AoR (Figure 19); a table detailing the identifying information, location, depth, and status of these wells and borings was uploaded to the GSDT tool. There are domestic, city, and industrial water wells to a maximum depth of approximately 400 ft (122 m).

There are 34 oil and gas wells and 55 other wells or borings described as stratigraphic test wells, engineering borings, coal test holes, and a coal mine shaft. Two of the 89 non-water wells and borings were completed to depths between 2,000 and 3,000 ft (610 and 914 m).

The Erp #1 well (API: 120530000100; 120530000102) has a total depth (TD) of 4,250 ft (1,295 m), which is within the Eau Claire Formation but does not fully penetrate it. The Eau Claire top at this location is 3,805 ft (1,160 m), and with a regional Eau Claire thickness of approximately 550 ft (168 m), an estimated 105 ft (32 m) of the formation remains below the well's TD. The well was drilled for oil in the early 1940s and is classified as Dry and Abandoned.

Historical Well Completion and Abandonment Details for Erp #1

Historical Oil and Gas Well Completion and Activity Records document that the Erp #1 well underwent multiple drilling and plugging phases, demonstrating proper isolation of the Eau Claire interval. The well was originally drilled in 1941 to 3,015 ft and temporarily abandoned, with plugging conducted within the Ordovician section before the well reached the Eau Claire Formation. Drilling later resumed, and by 1946 the well had been deepened to a total depth of 4,250 ft, encountering the Eau Claire at 3,805 ft. The final plugging operation, completed on May 8, 1946, sealed the well through the penetrated Eau Claire interval. The completion card shows that this interval was filled and sealed, with no evidence of open annulus, uncemented casing, or incomplete abandonment that could act as a conduit for vertical fluid migration.

There is a possibility that some historical coal test holes in the area may not be captured in the queried data sources. Based on mapped regional coal trends, any such holes would be expected to be less than 600 ft (183 m) deep.

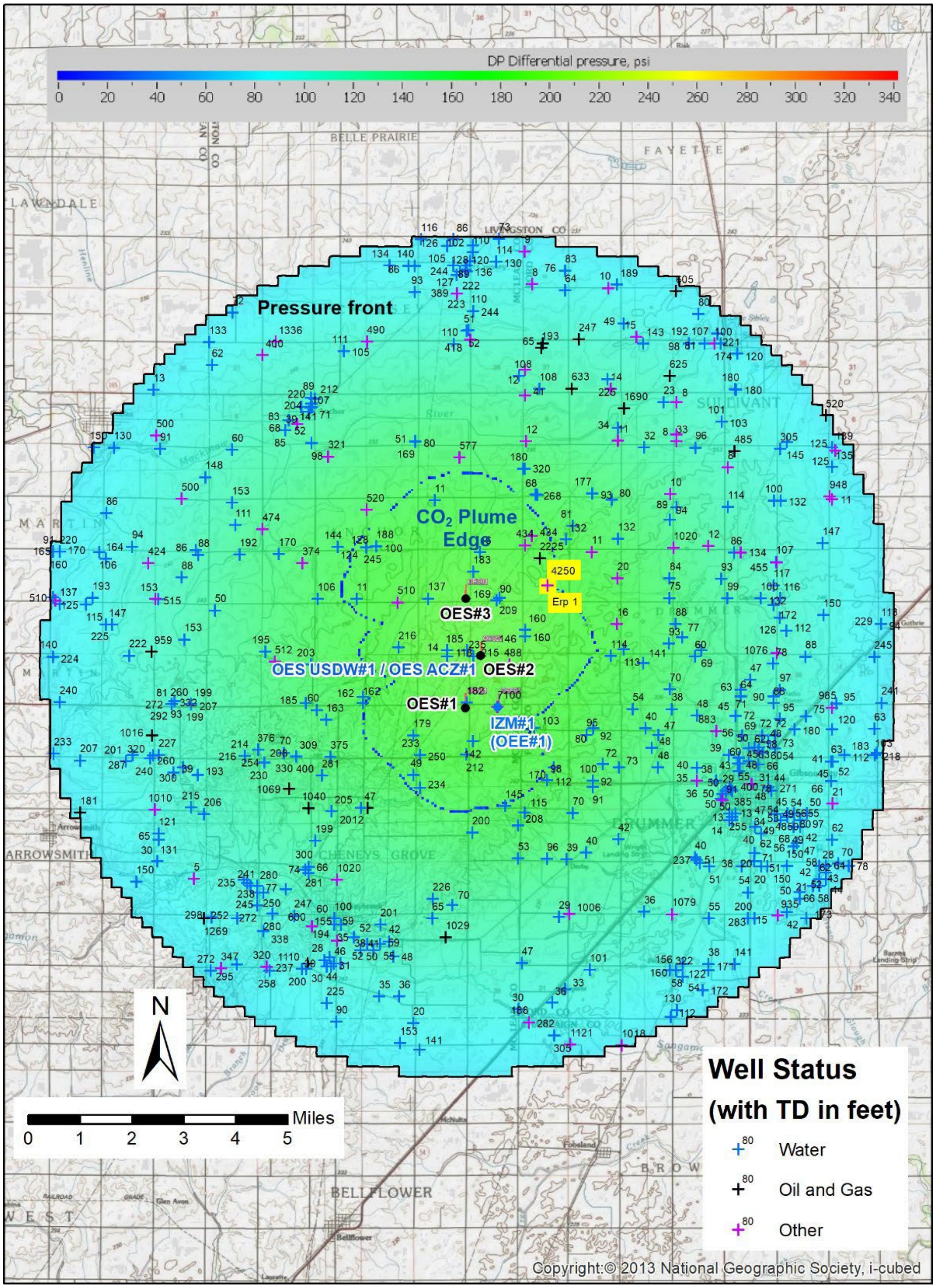

Figure 19. *Wells and borings within the Area of Review. USGS topographic base map. Project wells are labeled in larger bold print. The map corner coordinates (Decimal Degree NAD83) are NE: -88.309189, 40.681881; SE: -88.309316, 40.324745; SW -88.648083, 40.324319; NW -88.649757, 40.681450.*

Wells Penetrating the Confining Zone

The only well that fully penetrates the Eau Claire Formation is OEE #1.

According to the EPA, if a well is not fully penetrating the confining zone then no further action is needed (USEPA, 2013).

Plan for Site Access

No well fully penetrated the confining zone; therefore, no corrective action plan is required.

Corrective Action Schedule

Not applicable.

Reevaluation Schedule and Criteria

AoR Reevaluation Cycle

One Earth Sequestration, LLC will reevaluate the above described AoR every five years during the injection and post-injection phases.

The procedure below will be followed for the AoR reevaluation:

1) Input the actual injection rates into the model and simulate from inception to the time of the AoR reevaluation: the CO_2 plume, pressure front, pressure, and saturation of the projects' wells.

2a) Compare the measured pressure and saturation vs. time for all project wells to the simulation results and/or

2b) Compare the estimates of the CO_2 plume inferred from seismic to the simulated CO_2 plume.

3a) If 2a and 2b compare within triggers (next section), calibrate the model to the measured data for use in the next reevaluation cycle, or

3b) If 2a and/or 2b do not compare within triggers (next section), calibrate the model to the measured data and repeat process by starting at 2a).

4) Compare the AoR to the CO_2 plume and pressure front simulated in steps 2) - 3)

5) Decide if AoR estimated for permit should be updated.

Triggers for AoR Reevaluations Prior to the Next Scheduled Reevaluation

Changes to trends in injection rate, pressure change, and saturation with time at project wells, and CO_2 plume estimates based on seismic surveys may trigger an AoR reevaluation. Only quantitative thresholds expected to increase AoR substantially are included. The following may trigger a reevaluation:

- Rate: 50% increase over 12 months
- Pressure change: >50 psi (0.3 MPa) and 50% above simulated pressure.
- Saturation: CO_2 saturated interval (height) less than 50% of the simulated height

- CO_2 plume: Area of CO_2 plume greater than 50% of the simulated area of CO_2 plume or any single edge of the CO_2 plume exceeding 80% of the radius of the simulated plume edge.

These thresholds were selected to avoid significant differences between measured/interpreted and simulated injection rates, pressure, and CO_2 saturation distributions (CO_2 plume area) between scheduled AoR reevaluations.

A 50% injection rate over 12 months, 50% pressure increase, and 50% plume height decrease triggers were selected to ensure the reservoir model used adequately describes the geology of the storage formation. Similarly, reevaluating the AoR when the interpreted CO_2 plume area is greater than 50% of the simulated CO_2 plume area or any edge of the plume exceeds 80% of the simulated plume radius ensures development of reservoir models that properly describe the geology of storage formation.

The AoR was determined from simulations of specific injection scenarios using specific geologic models resulting in projections of CO_2 plume and pressure front sizes. Therefore, reevaluation of the AoR is planned in the context of changes to the injection scenarios simulated or monitoring observations (e.g., pressure or saturation) that are inconsistent with the model projections. In other words, if operations are similar to injection scenarios simulated and the monitoring results are similar to simulation projections, there is no need to reevaluate the AoR as it would be similar if not identical to the current estimate of AoR.

All models have unquantified error in projections, so small differences in scenarios and observations will be considered within the margin of error. The thresholds to trigger an AoR reevaluation were chosen based on exceeding general expectations of model projection errors.

One Earth Sequestration, LLC will discuss any such events with the UIC Program Director to determine if an AoR reevaluation is required. If an unscheduled reevaluation is triggered, One Earth Sequestration, LLC will perform the steps described at the beginning of this section of this Plan.

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