NexGen Carbon Oklahoma, LLC

Project Vanguard, Northeastern Oklahoma

Summary of Class VI Carbon Sequestration Permit Application to EPA

- **Permit Filed (June 24, 2025)**
- **Completeness Review Accepted (July 22, 2025)**

PROJECT BACKGROUND

NexGen Carbon Oklahoma, LLC ("NexGen") is a privately owned Oklahoma-based limited liability company that was established to develop a carbon dioxide ("CO_2") capture and permanent storage ("CCS") project in northeastern Oklahoma: the Vanguard CCS Hub (the "Project"). The Project is designed to mitigate the detrimental consequences of industrial CO_2 emissions while also being commercially viable. NexGen is owned by NexGen Carbon Solutions, LLC and Prairie Carbon Solutions, LLC. The parent companies of both owners have decades of prior experience in exploration and development of hydrocarbons in northeastern Oklahoma. Within the Project area, NexGen owns six-hundred and fifty (650) miles of pipeline including the associated easements and rights.

The proposed CO_2 storage site is located in Osage County, in northeastern Oklahoma. Initially, NexGen will develop the first phase of the Project ("Phase 1"). NexGen acquired approximately 75,000 contiguous acres of carbon storage leases for Phase 1 carbon injection. Currently, the surface lands above the proposed storage leases are primarily used for ranching and conservation. The development of Phase 1 entails the following: (i) constructing and installing capture facilities at nearby contracted industrial CO_2 emitters; (ii) constructing an extensive pipeline system to transport the CO_2, in a supercritical state from contracted industrial emission sites to the storage sites; and (iii) drilling and completing ten (10) injection wells, ten (10) above-zone wells, seven (7) in-zone monitoring and twelve (12) USDW seismic monitoring wells. The operational area for the sequestration sites covers several townships in Osage County with an Area of Review ("AoR") of one hundred and thirty-seven (137) square miles.

The expected rate for each injection well is eighteen (18) million cubic feet per day ("MMcf/D") of CO_2 or approximately three hundred and fifty thousand (350,000) metric tons per annum ("Mta") per injection well. It is anticipated that the CO_2 injection period for Phase 1 will be twenty (20) years and the total permanent quantity of CO_2 stored will reach approximately seventy million (70,000,000) metric tons ("Mt") collectively from the ten (10) injection wells. NexGen intends that Phase 1 of the Project will be fully operational by 2028, capturing, transporting, and storing CO_2 at volumes up to three million, five hundred thousand (3,500,000) Mta collectively.

The Project is designed to operate within safe geomechanical limits, maintaining injection pressures below ninety percent (90%) of the fracture gradient at the top of the Arbuckle Group. The injection wells are specifically designed to target the upper sixty percent (60%) of the Arbuckle, avoid low permeability zones in the lower forty (40%) and minimize the risk of induced seismicity. The Arbuckle, approximately nine hundred and fifty (950) feet thick, consists primarily of carbonate rocks from the Upper Cambrian and Lower Ordovician, capped by multiple impermeable confining units including the Woodford Shale and lower Mississippian Limestone with an average thickness of eighty (80) feet. These units provide containment while additional formations above the lower Mississippian offer tertiary confinement. NexGen will deploy above-zone monitoring wells to ensure confining integrity *via* in-zone wells to monitor the pressure front, and Underground Source of Drinking Water ("USDW") wells to detect CO_2 contamination and seismic activity. Additionally, 2D seismic monitoring will track plume growth and migration during and after injection completion.

The Project's AoR represents the area where USDW may be at increased risk due to the Project operations, as determined through modeling and simulation. The design indicates that ninety percent (90%) of the fracture gradient will never be reached during the injection period. The preliminary size of the AoR for the entire Phase 1 project site is approximately eighty eight thousand (88,000) acres. The spacing between each injection well is expected to exceed three thousand (3,000) acres. The AoR was modeled using the critical pressure threshold calculation, based on the characteristics of the USDWs, the injection zone and the maximum differential pressure occurring at the end of injection. Based on modeling and simulation results, the expected maximum sub-aerial extent of the CO_2 plume within the Arbuckle Group is approximately fifty-five thousand (55,000) acres and the expected critical pressure boundary of the entire AoR encompasses approximately seventy-seven thousand (77,000) acres. Following the drilling, coring, sampling and logging of a stratigraphic test well(s), the geologic model and simulation will be updated and revised to provide a more precise estimate of the AoR impacts.

The Project site is in an area of Oklahoma where only modest seismic events have been detected. Present USDW withdrawals within the AoR are from only five (5) shallow groundwater wells that are between one hundred (100) and two hundred and fifty-four (254) feet deep. These wells service only domestic users. Most importantly, and according to the Oklahoma Water Resources Board, there are no water source wells in northwest Osage County that provide water for human consumption.

The general topographic relief within the AoR is at an elevation between one thousand (1,000) and eleven hundred (1,100) feet above sea level. The area is mainly grasslands, with minimal relief and sparse forestland. The facilities for the site will be located exclusively on private land leased to NexGen which it plans to continuously monitor operations both at the surface and subsurface, and provide collected data to the Environmental Protection Agency ("EPA") within prescribed times and formats. Permitting and oversight for this project will be through the EPA, unless the State of Oklahoma is granted primacy over Class VI permitting.

Project Goals, Partners, and Collaborators

NexGen plans to partner with industrial CO_2 emitters from the nearby refining, power generation, fertilizer and cement manufacturing sectors to address CO_2 emissions at their source. The company will focus on demonstrating the feasibility and scalability of CCS technology to capture, transport and permanently store approximately seventy million (70,000,000) tons of CO_2 over a twenty (20) year injection period. NexGen has identified and is collaborating with the following:

- Prairie Carbon Solutions LLC
- Stanford Center for Carbon Storage
- Oklahoma Geologic Survey
- University of Oklahoma
- Baker Hughes Company
- Chart Industries
- Koch Energy Services
- SLB-Aker Carbon Capture
- ION Clean Energy
- Burns & McDonnell
- Quanta Services

Project Timeframe

Year	Activity
2024	• Started the Project by verifying the pore space ownership, conducting comparative market analyses and the leasing of seventy-five thousand (75,000) contiguous acres for injection and permanent CO_2 storage. • Initiated discussions with commercial, research & academic, engineering & technology partners, industrial emitters and the Osage Nation. • Began Class VI Permit Application preparations for submission to the EPA.
2025 – 2026	• Submit Class VI application, accounting for EPA Region 6 concerns. • Initiate Front End Engineering and Design ("FEED") work scope for carbon capture, transportation and storage with engineering & technology vendors. • Execute agreements with industrial CO_2 emitters. • Drill and evaluate a stratigraphic test well, acquire new 2-D seismic data and update geologic and computational models. • Accommodate and modify Class VI application to address additional EPA Region 6 and/or State of Oklahoma concerns required for approval.
2027 – 2028	• Execute engineering, procurement and construction agreements with carbon capture, transportation and storage vendors. • Obtain required permits for construction and installation of carbon capture, transportation and storage project components. • Construct and install carbon capture, transportation and storage project components. • Initiate carbon capture, transportation and storage activities.

Site Characterization

The site characterization included within the Class VI permit application will demonstrate that NexGen's proposed Vanguard CCS Hub is ideally situated for the permanent geological storage of CO_2. These reasons include, but are not limited to:

- The upper and middle section of the Arbuckle Group is an ideal injection zone of laterally continuous, thick [five hundred (500) to six hundred (600 feet)] carbonate with intervals of high-porosity [ten percent (10%) to twelve percent (12%)], and high permeability (10s to > 1,000 millidarcy) dolomitic limestone with occasional thin sandstone and shale beds. The Vanguard CCS Hub is expected to sequester three-hundred and fifty thousand (350,000) Mta, per injection well for a total of approximately seventy million (70,000,000) metric tons (Mt) over twenty (20) years.
- The Arbuckle Group lies beneath a sequence of geologic layers that effectively isolate it from the Vamoosa-Ada aquifer, the lowermost USDW. The primary confining unit, the combined shale beds of the Simpson Group and Devonian Woodford Shale, consists of low-permeability shale and mudstone. The secondary confining unit, the low permeability lower Mississippian Limestone, lies above the Simpson Group and Woodford Shale. Overlying these confining units are thick Pennsylvanian shales that further enhance isolation.
- The Arbuckle Group and confining units are not structurally complex. The formations have a gentle local and regional structural dip with few identified faults or geologic hazards within the modeled plume/pressure front extent AoR.

- Water samples indicate that the Arbuckle is saline – approximately one hundred and fifteen thousand (115,000) to one hundred and forty thousand (140,000) mg/L – with no economically recoverable hydrocarbon resources within the gross injection interval within the AoR.
- The injection and monitoring wells will be designed to prevent fluids from migrating to USDWs.
- NexGen will control the pore space occupied by the modeled plume.

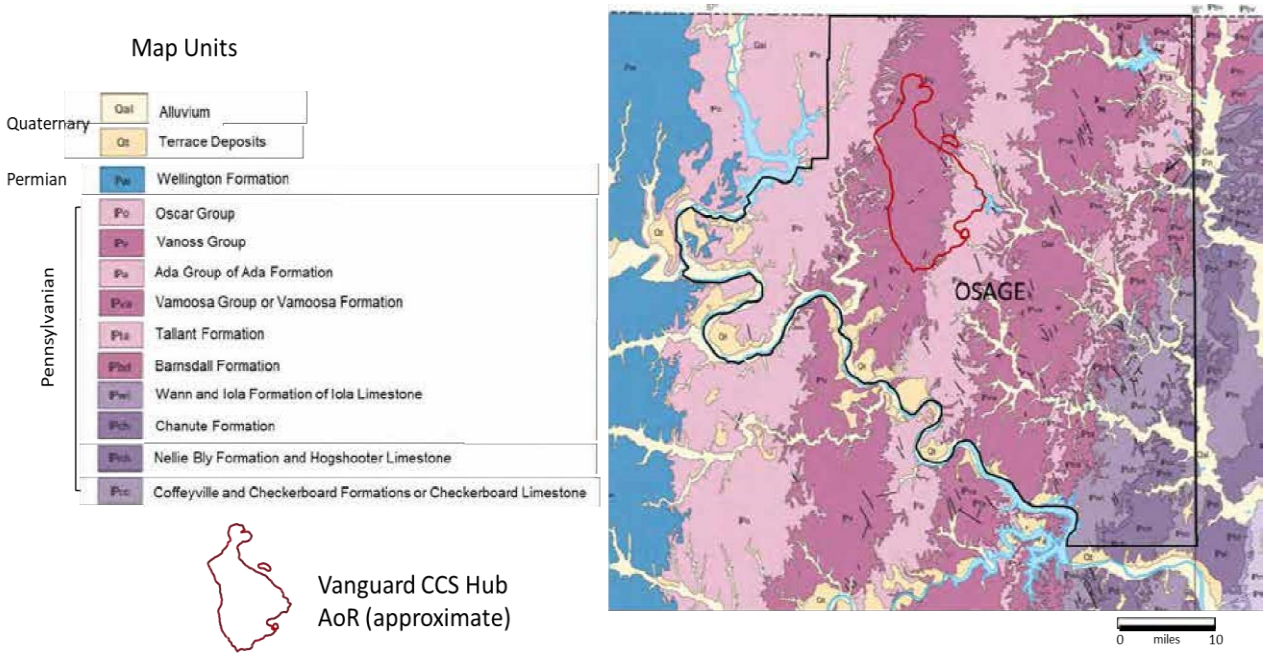
Data, information, and interpretations described in this section are summarized in the following text, demonstrating the Vanguard CCS Hub and AoR to be geologically and hydrologically favorable for the permanent storage of CO_2:

- The extent and structure of the Cherokee Platform, along with its tectonic setting, make it an ideal location for CO_2 storage. Much of the platform consists of relatively simple structures with shallow dips (less than one degree within the AoR). Recent faulting is absent from the injection and upper confining zones. No significant seismic hazards are present in the AoR.
- The regional geologic setting is well constrained due to thousands of wellbore penetrations from petroleum exploration and production that began in 1901 within the area.
- Within the AoR, the Cambrian-Ordovician Arbuckle Group is an excellent reservoir for injection with high porosity [average of seven percent (7%)] and permeability [geometric mean of twenty-six (26) mD].
- Within the AoR, the Arbuckle Group is highly saline with no economic quantities of hydrocarbons.
- The Arbuckle Group is encountered at adequate depths for pressures and temperatures favorable for storing supercritical CO_2 at reasonable cost, thousands of feet below currently exploited groundwater aquifers and the lowermost USDW.
- The Arbuckle Group is laterally extensive with no known stratigraphically or structurally trapped oil and gas within the AoR. Faulting within the AoR and the surrounding area is tectonic, and karst collapse in origin. Faults related to karst/collapse appear to sole-out within the upper Arbuckle and are detached from the lower Arbuckle and underlying granitic basement. While the top of the Arbuckle and the primary confinement interval (Woodford and Simpson Shale) appear to have occasional noticeable fault offset on seismic in the northern part of AoR (both tectonic and karst/collapse related), pressure and salinity data indicate isolation of the upper Mississippian Chat reservoir from the Arbuckle aquifer across geologic time. Further, interpretation and mapping of the AoR using GAM_Miss_Secondary Confinement Tophorizon demonstrates little to no fault offset, suggesting potential fault leakage risks above the secondary confinement zone could be considered minimal.
- The Arbuckle Group has the pore volume to store many times more CO_2 than proposed by this Project.
- The Arbuckle Group is vertically bound by the combination of shale in the Simpson Group and the Woodford Shale that forms a laterally continuous upper confining layer consisting of approximately four (4) to sixty (60) feet of low permeability shale and mudstone. Additional vertical confinement is provided by the lower Mississippian Limestone, the secondary upper confining zone. Thick, laterally continuous, shales in the Pennsylvanian section provide tertiary vertical isolation between the Arbuckle and lowermost USDW.
- As the Arbuckle Group is an open saline aquifer, CO_2 would be confined vertically by the overlying Simpson Group shale-Woodford Formation and lower Mississippian zone while

lateral confinement would initially occur via residual and solubility trapping and then ultimately *via* mineral trapping (Xu *et al*., 2001; Bachu and Adams, 2003; Bachu, 2006; Saadatpoor *et al*., 2010; Kampman *et al*., 2014; Ajayi *et al*., 2019). Separating the injection and storage interval from the basement will be achieved by a series of low-porosity, low-permeability dolomite beds that form flow baffles that impede and ultimately block the downward flow of injectate.

- No detrimental geochemical interactions are expected between the injectate and the formations or formation fluids. This expectation will be confirmed via future core and fluid analyses along with geochemical modeling.

AoR Map.



The complete Class VI Permit Application is available upon request.

<u>Project Contact Information</u>:

Marc Thomas
President & COO
NexGen Carbon Oklahoma, LLC
600 Rockmead Drive, Suite 112
Kingwood, TX 77339
817-239-2686
marcthomas@nexgencarbonsolutions.com