BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF SOUTH DAKOTA

IN THE MATTER OF THE APPLICATION BY SCS CARBON TRANSPORT LLC FOR A PERMIT TO CONSTRUCT A CARBON DIOXIDE TRANSMISSION PIPELINE

SD PUC DOCKET NO. _____

PRE-FILED DIRECT TESTIMONY OF ALEXANDER LANGE
ON BEHALF OF SCS CARBON TRANSPORT LLC

November 19, 2024

Q. Please state your name, employer, and business address.

A. My name is Alexander Lange. I am the Director of Engineering for Summit Carbon Solutions, LLC ("SCS"). My business address is 2321 N. Loop Dr., Suite 221, Ames, IA 2 50010

Q. Briefly describe your educational and professional background.

A. I have a Bachelor of Science in Electrical Engineering from Michigan State University. I have more than eight years of experience in the oil & gas industry working for various pipeline operators. Before working at SCS, I worked for Marathon Petroleum and as a seconded employee to WhiteWater Midstream, directly overseeing large scale capital projects of varying product types.

Q. What is your role with respect to the Project?

A. I am the Director of Engineering for the pipeline and pipeline facilities portion of the Midwest Carbon Express (MCE) Project. My primary role is to confirm technical deliverables for the Project are completed on schedule and meet quality and performance requirements under applicable regulations, Design Basis, and engineering design and specifications. As a part of my responsibilities, I also manage internal engineers and external engineering/technical contractors.

Q. What is the purpose of your Direct Testimony?

A. The purpose of my testimony is to provide information on the Project's engineering and design.

Q. What exhibits are attached to your Direct Testimony?

A. The following exhibit is attached to my Direct Testimony:

Exhibit 1: Resume.

Exhibit 2: South Dakota Risk Assessment Summary

Q. Please identify the sections of the Application that you are sponsoring for the record.

A. I am sponsoring the following portions of the Application:

- Section 1.8 – Other Required Permits and Approval
- Section 2.1.1 – Facility Description Overview
- Section 2.2 – Engineering Design

- Appendix 2 – PHMSA Compliance Table
- Appendix 3 – Typical Aboveground Facility Layouts
- Appendix 8 – Control Center Management and Leak Detection Overview
- Appendix 10 – High Consequence Area Mainline Valves - Confidential
- Appendix 13 – Soil Heat Transfer Study
- Appendix 24 – South Dakota Phase I Geohazards Assessment Report
- Appendix 25 – SD County Setback

Q. Provide a general description of the Project.

A. The Project will include approximately 698 miles of pipelines (mainline, trunklines, and laterals) in South Dakota as well as 6 pump stations, 120 MLVs, 15 launcher and receiver sites, and 15.9 miles of temporary and permanent access roads

Q. What is the design and construction standard by which the Project will be built?

A. The Project will be designed, constructed, inspected, tested, and operated in accordance with applicable requirements and regulations, including the U.S. DOT regulations in 49 CFR Part 195 (Transportation of Hazardous Liquids by Pipeline), American Society of Mechanical Engineers (ASME) Standard B31.4 (Pipeline Transportation Systems for Liquids and Slurries Standard), as well as other applicable technical standards.

To comply with the regulations, standards, and SCS's internal quality standards, SCS will implement a quality assurance and quality control plan (QA/QC Plan(s)). The QA/QC Plan(s) will establish technical inspection policies and procedures during manufacturing and construction activities, as well as delineate the duties and responsibilities of each QA/QC inspector assigned to the Project.

Q. Were the criteria set forth in SDCL § 49-41B-22 considered by SCS when designing the Project?

A. Yes.

Q. Has SCS applied or does SCS intend to apply for any waivers from PHMSA?

A. No. SCS does not currently anticipate applying for any waivers from PHMSA.

Q. What is the design capacity and design pressure of the Project?

a. The Project has been designed as follows:

- Design capacity: The mainline can transport up to approximately 18.5 million metric tons per annum (MMTPA) of CO_2.
- Maximum Operating Pressure (MOP): 2,183 pounds per square inch gauge (psig).
- Maximum Operating Temperature: 120 degrees Fahrenheit.

The design of the pipeline system is based on a maximum discharge pressure of 2,160 psig at each pump station, with a 2,183 psig MOP of the pipeline. The maximum discharge pressure of the pipeline is based on a steady state and transient analysis to identify pressure requirements under normal and abnormal operating conditions.

Q. Please describe the Project's pipeline.

A. The Project's pipeline will be constructed of high-strength carbon steel pipe, meeting, and in some instances exceeding, the American Petroleum Institute (API) 5L Pipe Specification and will feature a series of laterals, trunk lines, and mainlines (see Figure 2 of the Application). Mainlines are pipelines that carry CO_2 from trunk lines to the proposed sequestration facility. Trunk lines are pipelines that carry CO_2 from ethanol plants to mainlines or from lateral pipelines to the mainline. Laterals are pipelines that carry CO_2 from ethanol plants to trunklines.

Based upon volume requirements and pressure service, pipe segments will range in size from 6- to 24-inches nominal diameter and have a wall thickness ranging from 0.203 inches to 0.750 inches. Pipe wall thicknesses vary based on the design factor, which is determined by location and installation method; conventional pipeline installation (Design Factor 0.72), road crossings (Design Factor 0.6), railroad crossings (Design Factor 0.5), and horizontal directional drills (HDDs) (Design Factor 0.5 or 0.6 depending on site specific design). To protect against corrosion, SCS will apply an external fusion bonded epoxy (FBE) coating to the pipeline and an impressed current cathodic protection (ICCP) system will be used. Pipeline installed in HDDs and road crossings will also have an Abrasion Resistant Overcoat (ARO) installed as a secondary coating over the FBE. All material will be manufactured, constructed, and operated in accordance with applicable regulations.

Q. Please describe the FBE coating that will be applied and its purpose.

A. FBE coating consists of resin and hardener components in a powder form. When the powder is sprayed onto the heated pipe surface, the powder components combine to form a bond to the steel surface and provide a coating barrier between the steel pipe and corrosive environments.

Q. Please describe the Project's use of an impressed current cathodic protection (ICCP) and AC mitigation system.

A. The Project's ICCP system will be installed along the buried pipelines to mitigate the threat of external corrosion on the pipe. The ICCP system involves multiple sacrificial anodes installed in deep well ground beds along the pipeline that are connected to external power. The power provides the current needed to drive an electrochemical reaction whereby the anodes corrode instead of the pipeline. Except for a junction box and small diameter vent pipe posted above deep well ground beds, the ICCP system will be buried. The ICCP system components will be located within the capture and pipeline facilities. The ICCP system will be continuously monitored and maintained for the life of the pipeline system. The FBE coating coupled with the ICCP system provides a level of redundancy to mitigate external corrosion of the steel pipe.

Depending on the final design, SCS may need to install AC mitigation where necessary to protect the pipelines and the ICCP system from the corrosive electromagnetic voltage and stray current from nearby electric powerlines. AC mitigation systems, if required, will be installed within the permanent ROW with aboveground equipment at the MLV sites.

Q. Please describe the Project's pump stations.

A. The six pump stations in South Dakota (Mainline Pump Stations [MPS] -04, -05, -06, -07, -08, and -09) will be located in Minnehaha, Lake, Beadle, Spink, and McPherson counties. Each pump station will be fenced and contain up to four pumps driven by electric motors, an electrical building, electrical substation, a pump shelter building, communications equipment, and parking area for station personnel. Design and construction of the pump stations will meet the requirements of the National Electric Code and Federal regulation 49 CFR Part 195. The Project will purchase electricity for the pump stations from local providers. In the event the local providers require upgrades or additional infrastructure to service the pump stations, SCS will cover those costs. Pump stations will be fully automated for unmanned operation via the MCE Project's Operations Control Center (OCC). SCS will maintain both a primary and secondary OCC. Remote start/stop set point controls, unit monitoring equipment, and other data collection equipment will be installed at each location. The pipe entering and exiting the pump station will be located underground; however, some of the piping within the pump station yard will be above ground.

Pump stations will utilize electricity for all pumps, lights, and heating in the buildings. SCS will also utilize a variety of direct detection methods at pump stations including CO_2 detectors as

well as thermal cameras that would capture the heat signature of CO_2 changing phases from supercritical to gas.

Q. Please describe the Project Mainline Valves (MLVs).

A. SCS plans to construct a total of 120 MLVs, 48 of the MLVs will be located within the operational footprint of pump stations, capture facilities, and launcher and receiver facilities, and 72 will be standalone intermediate mainline valves. The standalone intermediate MLVs will be sectionalizing block valves constructed within a 50-foot-wide by 50-foot-long site located within the 50-foot-wide, permanently maintained pipeline ROW. These intermediate valve sites will be located within a permanent aboveground easement obtained from landowners. The spacing intervals between the MLVs along the ROW will be in accordance with 49 CFR Part 195.260. This includes, but is not limited to, valve requirements for waterbody crossings, pump stations, and to minimize risks to High Consequence Areas (HCAs) from accidental CO_2 discharges. Appendix 10 of the Application identifies the location of the HCAs and the associated MLVs that were sited to protect the HCAs.

All of these MLVs will be remotely activated valves. In the unlikely event of an emergency, these valves can be remotely activated to isolate sections of the pipeline to minimize potential discharge. The valves will also be designed to allow for local operation. All mainline valves will be electrically actuated, have upstream and downstream pressure transmitters, redundant communications, and a local Programmable Logic Controller (PLC). The pipeline will be controlled via the OCC Supervisory Control and Data Acquisition (SCADA) system which will operate 24/7, 365 days a year.

Q. Can you further describe how do each of the MLVs work?

A. Yes. All MLVs will be electrically actuated, have upstream and downstream pressure transmitters, redundant communications, and a local PLC. During the commissioning process, all remote devices on the system will be point to point checked from the end device to the control center SCADA system screen. All associated alarm and shutdown set points are confirmed and documented with the control room. The SCADA system polls data (such as pressures from the pressure transmitters) at intervals from 3 to 9 seconds. The transmitters will have rate of change alarm as well as low- or high-pressure alarms. In the event of a leak (and associated pressure drop), an alarm will be sent to the pipeline controller which will notify the controller of an upset condition, or in the event of a large pressure drop, will trigger the MLV to shut automatically. The

command could be sent in a matter of seconds, and then valves would shut according to their closure times. MLVs are tested at least twice a calendar year to ensure functionality.

Q. What are the estimated valve closure times?

A. The Project will be controlled using our control center SCADA system which will operate 24/7, 365 days a year. The valve closure times range from approximately 15 to 120 seconds, depending on pipe size. However, valve closure will consider operational conditions to ensure safe closure without impacting pipeline integrity.

Q. Please describe the Project's launcher-receiver facilities.

A. All pipeline segments will allow the passage of internal or inline inspection devices (commonly referred to as "smart pigs"), which are designed to travel through the pipeline to detect internal and external anomalies in the pipe such as corrosion, dents, and other irregularities or to clean the pipeline and remove liquids. Launcher and receivers are designed to launch and receive these internal inspection devices. All launcher and receivers will be aboveground fabricated settings which will have a design factor of 0.6 with an appropriate corresponding pipe wall thickness. Typical drawings of the Project's aboveground facilities are provided in Appendix 3 (Typical Aboveground Facility Layouts) of the Application.

Q. Please describe the access roads that will be constructed for the Project.

A. The Project pipeline will require 70 temporary access roads for construction and 92 permanent access roads for operations. When possible, existing public or private access roads will be used as temporary access roads to access the construction workspace. If new temporary access roads need to be constructed, temporary access roads will be removed in their entirety and the footprint restored to previous land uses post construction, unless otherwise agreed upon with individual landowners. Permanent access roads will provide access to 72 MLVs and 15 launcher and receiver sites. Access roads will be 30 feet wide and will be constructed by grading and applying gravel as required to provide a drivable surface and to prevent erosion. Any permanent roads will be designed and constructed to county/township standards and state requirements, where applicable.

Q. Does the Project include compressor stations?

A. No.

Q. Does the Project include storage facilities?

A. No.

Q. What has the Project done to mitigate potential surges that could cause the pipeline to overpressure?

A. SCS completed a comprehensive surge analysis on the entire system to ensure compliance with the PHMSA regulations, specifically 49 CFR Part 195.406(b), which requires system pressures to not exceed 110% of the system's MOP during transient or other abnormal activities. SCS took a conservative approach during this analysis in that only local system controls were considered for system protection. In reality, the control center operators will be an extra layer of protection in any upset condition. The surge analysis was conducted using actual proposed operating conditions and design-flow rates, pipe sizes, elevation changes, pump and compressor curves, product composition, valve closure times, and a variety of other factors. The analysis determined that the pipeline system was adequately protected from overpressure in all inadvertent valve closure scenarios meaning that the system cannot be over pressured by a mainline valve shutting either normally or abnormally. Even though the surge analysis could not identify any risk of overpressure, SCS is implementing surge mitigating automation such as automatic pump station shut down with downstream valve closure. This analysis will be updated and expanded as the pipeline system grows or additional volume is added.

Q. Does SCS have a plan to avoid internal corrosion?

A. Yes. There are a number of ways that SCS is addressing internal corrosion. The most important factor defining the potential corrosivity of supercritical CO_2 is the possibility of a separate water phase condensing out of the CO_2 stream resulting in a free water phase. To mitigate this, SCS will install a triethylene glycol skid at every capture facility to dehydrate the CO_2 stream. SCS will also install moisture analyzers at every capture facility to ensure the CO_2 stream meets system specification before it enters the pipeline. If the CO_2 stream does not meet system specification, an alarm would immediately notify the Control Room which would trigger the shutdown of the capture facility, effectively isolating the capture facility and preventing elevated water content CO_2 from entering the pipeline. In addition, SCS will install corrosion monitors at every capture facility. SCS will also install pig launchers and receivers which will be used to facilitate launching of maintenance pigs (as required) as well as to conduct periodic in-line assessments with smart tools to monitor pipe integrity.

Q. What kind of data will be collected and transmitted to the Operations Control Center?

A. The SCADA system will be utilized to continuously monitor sensing devices located at strategic points along the pipeline to collect data that will allow SCS to trend and monitor pressure, temperature, and flow of CO_2 under transport. This data collection will be utilized to ensure the pipeline operation is maintained within established operating parameters. OCC personnel have the capability to remotely shut down the capture facility and isolate pipeline segments via the Project's MLVs to isolate pipeline segments in the event abnormal operating conditions are observed.

Additionally, a Real Time Transient Model ("RTTM") leak detection system will be deployed. The RTTM is a real time hydraulic model of the pipeline that runs alongside the actual pipeline. When the behavior of the pipeline does not match the hydraulic model, it indicates an issue that must be addressed by OCC personnel. In the case of sudden changes in operating pressure, alarms will sound to indicate that a variation in the leak profile has been detected.

Q. Can you further describe the Project's current planned leak detection system?

A. SCS plans to install Atmos Pipe, which meets API Recommended Practice 1175 – Pipeline Leak Detection – Program Management. Each leak detection system's performance (including the one SCS will install) must be tested before acceptance for deployment. Performance testing includes a wide variation of potential operating conditions. Alarm tuning needs a baseline and uses real time flows and temperatures and is impossible to test without a phase one pipeline build. Atmos is one of the most experienced leak detection vendors in the world. They have installed more than 1,700 systems in 65 countries with more than 900 in North America. SCS's multi-layer leak mitigation/detection system approach employs:

- Atmos Pipe Computational Pipeline Monitoring;
- Custody transfer quality metering at all receipt and delivery sites;
- Twelve over/short segments, thus increasing the sensitivity of the system to more quickly determining a loss of containment site;
- Space based geohazard analysis for determining landscape changes after significant weather events;
- "Rate of Change," automatic valve closure capability (Both valve site pressure transmitters capable of closing a valve at a programmed low-pressure set point automatically);
- A line pack calculation that maintains a system inventory balance calculating the receipts and deliveries displaying the loss or gain of CO_2 in the pipeline;

- Pipeline training simulator built using the SCS system diagram with site elevations. This world class tool will safely expose our pipeline controllers to dozens of leak scenarios before the system becomes operational.

Q. Have you been involved with the Project's analysis regarding Risk Assessment?

A. Yes. Risk is commonly defined as the product of the probability of an event occurring and the resulting consequence of that event. To create a thorough risk assessment, input from various technical experts is required, many of whom I oversee in my role. The Project has engaged various technical experts, including but not limited to, dispersion, environmental, toxicology, geohazards, and surge analysis. Risk assessment results will be discussed further in future testimony. SCS's analysis shows that the proposed pipeline will have an extremely low likelihood of failure and that the average consequence of such a failure is moderate.

The South Dakota Risk Assessment Summary is attached to this testimony as Exhibit 2.

Q. Has the Project commissioned a Geohazard Analysis?

A. Yes. SCS commissioned a Phase I Geohazard Assessment, which is attached to the Application as Appendix 24.

Q. Discuss the existing geological resources, seismic risks, and subsidence potential along the proposed route.

The geological and soil resources present within the Project footprint are compatible with Project development. No sand or gravel mining sites, or oil and gas wells, are located within the Project footprint. All areas within the Project have either no geohazard risk or a low geohazard risk due to the presence of karst features. Additionally, all areas within the Project footprint are in areas identified as having low susceptibility to landslides. There are no known areas crossed by the Project that present significant geologic hazard risks due to seismic activity, ground subsidence, or slope instability. For additional information regarding geologic resources within the Project footprint, see Section 5.1.2 of the Application.

Q. What measures will SCS take to avoid, minimize, and/or mitigate potential impacts to geologic resources?

A. As discussed in Sections 5.1.5 of the Application, the geological conditions, including geologic formations, seismic risk, and subsidence potential, within the Project footprint are not anticipated to significantly impact construction or operation of the Project. Once the Project is

installed and the ROW restored, the operation of the Project will not contribute to seismic, subsidence, or slope instability.

Q. As proposed, does the Project meet or exceed all applicable federal and state standards?

A. Yes.

Q. Have you been involved with the discussion regarding SCS's request to the Commission to exercise its authority under SDCL 49-41B-28 to preempt and supersede unreasonably restrictive county ordinances.

A. Yes. There are six county ordinances that SCS is requesting the Commission exercise its statutory authority to supersede and preempt to the extent that they are unreasonably restrictive. At this time, those specific ordinances are from Brown, Edmunds, McPherson, Minnehaha, Sanborn, and Spink counties.

Q. You have testified to the engineering and design of the Project. Do any of the county ordinances purport to regulate the engineering and design of the Project?

A. It is unclear at this time. Some of the ordinances are written very broadly and lack clarity around what information each county will seek or the intended purpose for requested information. For example, McPherson County's ordinance requires the Project to "file all associated plans of the proposed pipeline". McPherson County has indicated that it may hire a third-party engineering firm to review deliverables. Sanborn's ordinance requires the Project to file "a set of plans and specifications showing the dimensions and locations of the transmission pipeline, including plans and specifications for all related facilities, and aboveground structures, including without limitation: pumps, valve sites and shutoff valves." Other counties may also gain interest in the engineering and design of the Project.

Ultimately, Sanborn, McPherson, or any other county, do not specifically regulate the engineering and design of the Project per se, but it is apparent they have interest in the topics. Because of that, the Project is left in a state of uncertainty regarding what each county is requesting.

Q. Can you describe to me why that is unreasonably restrictive?

A. I personally met with the McPherson County Planning & Zoning board on November 29, 2023, with the goal of trying to better understand the request from the county. The county made

general statements around not being experts in pipeline engineering and design; they indicated they wanted to contract a third-party engineering firm to review the required deliverables. If the expectation of the various counties that have enacted ordinances, such as McPherson and Sanborn, is to hire third-party engineers to review and provide feedback on these required deliverables, this may create a potential conflict with state and federal requirements. In addition to those conflicts, there is nothing to say that each county may have separate requirements that are inconsistent. It is unreasonable and impractical for the Project to be subject to multiple county ordinances regarding engineering and design of the Project that may conflict.

As structured today, it is my understanding that the Commission Staff hires third-party expert witnesses to provide feedback on deliverables developed by SCS. If the counties hire a separate third-party engineer to provide feedback on the deliverables, there is a chance their conclusions or recommendations do not align with the Commission or federal regulatory bodies. This creates uncertainty about which regulatory body, the Commission or the counties, makes the final decision about possible permit conditions and the engineering and design of the Project. The Commission's technical staff may deem SCS's deliverables satisfactory, but counties may impose different, potentially conflicting requirements that must be met prior to receiving a conditional use permit and create a conflict with the Commission's regulatory authority.

Q. Have you been involved with discussions with any of the counties? If so, which counties?

Yes, I have been to county commission meetings in Brown, Spink, Edmunds, and McPherson County since September of 2023.

Q. In your opinion, how have those discussions gone?

A. The conversations were cordial generally, but despite its best efforts, the Project has not been able to find common ground. For example, I worked extensively with the Edmunds County Commission; I attended nine county commission meetings from October 10, 2023, through April 9, 2024. We provided information regarding emergency management, detailed maps, and various other data we have shared with the Commission through this Application. Throughout all of that, the Edmunds County Commission's approach seemed to be that our Project should be regulated similarly to a Concentrated Animal Feeding Operation (CAFO). In my opinion, those type of restrictions simply do not work for a linear Project.

SCS has made sustained and genuine attempts to work with the counties, listen to their concerns, and share the impact of each county's ordinance on the Project. SCS has carefully considered the local ordinances when developing the Project and fully intends to comply with the local ordinances where it can. However, as described in more detail in the direct testimony of Erik Schovanec, there are numerous examples where it is not practical, or even possible, to comply with every part requirement of each county's ordinance. Therefore, where it cannot, SCS is asking the Commission to supersede and preempt the ordinances.

Q. Does this conclude your direct testimony?

A. Yes.

Dated this 19th day of November, 2024.

/s/ Alexander Lange

Alexander Lange