BEFORE THE PUBLIC UTLITIES COMMISSION

OF THE STATE OF SOUTH DAKOTA

IN THE MATTER OF THE APPLICATION OF SCS CARBON TRANSPORT LLC FOR AN ENERGY FACILITY PERMIT TO CONSTRUCT THE SUMMIT CARBON SOLUTIONS PIPELINE	DOCKET NO. HP22-001

DIRECT TESTIMONY OF

JOHN GODFREY

ON BEHALF OF

SCS CARBON TRANSPORT LLC

<u>SCS CARBON TRANSPORT LLC EXHIBIT #</u>

November 2, 2022

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Exhibit W179 (Late-filed) - Godfrey direct testimony before the South Dakota PUC
Intervenor John H. Warford, Jr., as Trustee of Revocable Trust

I. INTRODUCTION

Q. Please state your name, business address, and present position.

A. My name is John F. Godfrey. I currently serve as a Senior Principal Consultant with the Integrity Solutions and Compliance Department within the Energy Services Group of DNV GL USA, Inc. ("DNV"), with a business address of 5777 Frantz Road, Dublin, OH 43017.

Q. Please describe what DNV does.

A. DNV is the leading technical advisor to the global energy industry. We provide consistent, integrated services within technical and marine assurance and advisory, risk management and offshore classification, to enable safe, reliable, and enhanced performance in projects and operations. Operating in more than 100 countries, our over 12,000 professionals serve our customers in the maritime, oil and gas, energy, and other industries. DNV services span the entire value chain of carbon dioxide ("CO_2") from capture and conditioning to compression, transport, utilization, and storage. DNV is a recognized global authority in onshore and offshore pipeline integrity asset management. Our subject matter experts ("SME") are backed by industry-leading laboratories and research scientists for material testing, modeling and simulations, corrosion research, failure analysis, technology, and equipment. We build trust for industries, investors, and governing bodies globally from strategic planning through technology demonstration to operational excellence.

Q. On whose behalf are you providing testimony in this docket?

A. On behalf of SCS Carbon Transport LLC (the "Applicant").

Q. Have you previously submitted or prepared testimony in this proceeding in South Dakota?

A. No.

Q. What is the purpose of your direct testimony?

A. I was retained by the Applicant to prepare direct testimony and analysis of pipeline safety considerations related to the Applicant's proposed CO_2 pipeline project in South Dakota, and to address safety concerns raised by the public.

Q. Please describe your educational background.

A. I have a Bachelor of Science in General Engineering with an emphasis in Hydraulics and Strength of Materials from the University of Illinois, which I received in 1987. A copy of my C.V. is included with this direct testimony.

Q. Please describe your professional experience pertinent to your assignment in this proceeding.

A. I have over 35 years of experience related to pipeline design, construction, operation, maintenance, regulatory compliance, and safety issues, including 22 years with hazardous liquid pipeline operators. Over the years I have held various positions in pipeline engineering, operations, manufacturing, consulting, and asset integrity services. I have developed and managed Integrity Management Programs for pipeline companies. My experience also includes regulatory compliance, standards development, pipeline operations, pipeline design and construction, line pipe manufacturing, and non-destructive examination. I am a past Chairman of the American Petroleum Institute ("API") Pipeline Integrity Committee, a past Vice Chair of the Pipeline Research Council International Materials Committee, and a previous member of the API Operations Technical Committee.

II. SAFETY OF THE PROJECT

Q. Have you attended any South Dakota public meetings regarding the project?

A. Yes, I have. I attended the March 2022 South Dakota Public Utilities Commission ("SD PUC") public input meetings in Onida, Sioux Falls, De Smet, and Redfield South Dakota.

Q. What safety concerns were raised in the public meetings?

A. Members of the public expressed concerns regarding the risks of a potential release, safety regulations for CO_2 pipelines, depth of cover over the pipeline, and isolation valve spacing amongst other issues.

Q. Do CO_2 pipelines present heightened safety risks to surrounding people or the environment?

A. Not compared to other types of pipelines, but the concern is understandable given that many of these communities are not familiar with CO_2 pipeline infrastructure. At DNV, we undertake research specific to CO_2 pipelines to quantify and understand potential safety hazards. This research enables us to help pipeline developers and operators anticipate the consequences in the highly unlikely event of a release. This research also allows developers and operators to plan and implement solutions to mitigate risk.

Q. Are there codes and standards that address CO_2 pipelines?

A. Yes. The Applicant's pipeline project is being designed and built to Department of Transportation ("DOT") Pipeline and Hazardous Materials Safety Administration ("PHMSA") hazardous liquid pipeline regulations at Title 49 Code of Federal Regulations ("CFR") Part 195. These are the same rigorous requirements that apply to gasoline, anhydrous ammonia, and propane pipelines.

Q. What are the specific requirements for CO_2 pipelines?

A. In addition to setting standards for all hazardous liquid pipelines, federal regulations include specific requirements that are applicable to the Applicant's CO_2 pipelines. For example, CO_2 pipelines must be designed to resist ductile fracture.[1] Ductile factures are running cracks that can originate at a failure. These types of fractures are driven by the compressibility of the CO_2 in the pipe and can affect several pipe joints (i.e., where 40-foot sections of pipes are welded together). To comply with PHMSA's design regulation and minimize this risk, the Applicant has committed to installing heavier wall pipe and fracture arrestors throughout the system where needed. Additionally, federal regulations require that CO_2 pipelines conduct an air dispersion analysis to determine how CO_2 released from the pipe would impact people and the environment. This analysis, which also incorporates local terrain, is prepared to comply with PHMSA's liquid Integrity Management program regulations.[2] Dispersion and overland spread analysis allows the Applicant [and agencies] to understand the potential consequences of a CO_2 release. Under PHMSA's Integrity Management regulations, the Applicant will also use this analysis to inform its selection of appropriate preventive and mitigative measures including valve locations, emergency response planning and preparedness to reduce those potential consequences.

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[1] 49 CFR §195.111, Fracture propagation.
[2] 49 CFR § 195.452.

Q. Are there industry standards that provide more guidance?

A. Yes. Federal regulations incorporate a number of industry standards by reference.[3] Additional standards are available for pipeline developers' and operators' use. These standards are provided by the American Society of Mechanical Engineers, NACE International, API, and DNV to name just a few.

Q. How does the depth of cover of the pipeline relate to safety?

A. I heard several comments in the public meetings about the planned depth of the pipeline. The primary concern was that pipe above the frost depth of about six feet would be over-stressed and possibly fail. Pipeline safety regulations in the U.S. require 30 inches of cover over a pipeline in rural areas and three feet in other locations unless the pipeline is in rock.[4] This is for pipelines in all climates, including South Dakota. Welded steel line pipe is not as susceptible to failures due to frost heave, like water or sewer lines. Moreover, there is a long history of hydrocarbon pipelines installed throughout the frost-prone, northern tier of the United States that have operated without frost-related damage at the burial depths set out in the Part 195 regulations. PHMSA guidance states that operators should use geotechnical engineers during the design, construction, and ongoing operation of a pipeline system to ensure that sufficient information is available to avoid or minimize the impact of frost heave on the integrity of the pipeline system.[5] The Applicant is designing the pipeline for four feet of cover at a minimum in all locations as an additional safety measure, not because of frost concerns, but rather to reduce the risk of third-party strikes.

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[3] 49 CFR § 195.3 What documents are incorporated by reference partly or wholly in this part?
[4] 49 CFR § 195.248, Cover over buried pipeline.
[5] Advisory Bulletin, Pipeline Safety: Potential for Damage to Pipeline Facilities Caused by Earth Movement and Other Geological Hazards, 87 Fed. Reg. 33,576 (June 2, 2022).

Q. What other safety measures do pipeline operators take?

A. As a part of commissioning a pipeline, operators conduct a hydrostatic pressure test to confirm the design strength of the pipeline and verify it is leak free. This test is conducted al levels between 125% and 150% of maximum operating pressure ("MOP") and is held for at least four hours and at 110% MOP for another four hours.[6] The pressure test serves as the pipelines baseline integrity assessment. In conjunction with the pressure test, an in-line caliper inspection tool is run to identify any dents or deformations indicative of construction damage. Following the start of operations, hazardous liquid operators are required to conduct integrity re-assessment utilizing pressure testing or in-line inspection ("ILI") tools capable of finding metal loss and deformations that might result from corrosion or mechanical damage.[7] Pipeline operators are also required to implement cathodic protection ("cp") to guard the pipeline against external corrosion and inspect the performance of the cp system annually.[8] The Applicant is also conducting an AC interference survey to ensure their cp design is adequate.[9] Operators also conduct regular inspections of the pipeline right-of-way and participate in one-call and damage prevention programs to prevent third party damage.[10]

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[6] 49 CFR Part 195, Subpart E.
[7] 49 CFR § 195.452.
[8] 49 CFR Part 195, Subpart H.
[9] AC interference surveys identify areas of induced alternating current on the pipeline, such as from nearby high-tension power lines, that can cause corrosion.
[10] 49 CFR §§ 195.412 and 195.442.

Q. Do pipeline safety regulations address potential releases?

A. Yes. CO_2 pipelines, like other pipelines governed by PHMSA, must have emergency response plans, conduct training, qualify their personnel, and provide information to first responders and the public.[11]

Q. How are the consequences of a CO_2 release determined?

A. DOT regulations require operators of CO_2 pipelines to consider the dispersion of CO_2 in the atmosphere and estimate the resulting plume. This is done with air dispersion modeling, that is prepared to comply with the Integrity Management regulations.[12]

Q. What is air dispersion modeling?

A. Air dispersion modeling is a process that estimates where a gas or vapor release will go in the atmosphere. Similar to the CO_2 that can be seen intentionally discharging from an ethanol plant, a gas moves away from the release point as a plume and dissipates as it gets further away. Air dispersion models use computer algorithms to predict the direction, speed, and concentration of the plume until it dissipates into the air. Dispersion models also account for how topographical features may affect dispersion, and these models help pipeline operators assess the risk to people and the environment along the pipeline.

Q. What kind of variables are considered in air dispersion modeling?

A. Dispersion models consider variables such as release rate, leak profile, wind speed and direction, atmosphere stability, humidity, and land use. Air dispersion modeling for CO_2 pipelines uses conservative, worst-case assumptions to inform operators of the potential risk of even the most unlikely release. For example, a release on a calm day, with certain

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[11] 49 CFR §§ 195.402, 195.403, 195.440, and subpart G.
[12] 49 CFR § 195.452.

atmospheric conditions, and located exactly in the worst-case topography will produce a dispersion estimate that appears excessive. While real world conditions may produce a different result, the air dispersion modeling helps operators and communities understand the potential worst-case risks and plan accordingly.

Q. Has air dispersion modeling been validated by testing?

A. Yes. DNV has built up considerable experience in carrying out experimental studies and product testing for dense phase and gaseous phase CO_2. This has included carrying out the world's first two full scale fracture propagation experiments involving CO_2 rich mixtures (in excess of 90% CO_2 by mass), with the mixture in the dense phase at a specified temperature. These tests were used to provide empirical data to validate dispersion models. DNV has carried out experimental work on behalf of a number of different collaborative projects involving industry and regulators.

Q. How does the spacing of valves affect a CO_2 release?

A. Because CO_2 disperses in the atmosphere, the distance a release travels is more significantly impacted by factors like weather and the surrounding land than the volume of the release. For example, a CO_2 release on a windy day will dissipate more quickly and in less distance than on a calm day. The health effects of CO_2 exposure are determined by the concentration of CO_2 and how long a person is exposed.[13] Valve spacing can limit the total volume released and the duration of the release, and therefore how long people may be exposed.

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[13] DNV-RP-F104, Design and Operation of Carbon Dioxide Pipelines, September 2021, Table 3-5 Occupational exposure limits (OEL)

Q. Where does the Applicant intend to install valves?

A. Valves will be installed based on the location of High Consequence Areas ("HCA"), which include populated areas and sensitive environments; PHMSA requirements such as at pump stations, major river crossings, and sensitive waterbodies.[14] The Applicant will comply with PHMSA's newly adopted, more stringent valve spacing regulation that requires valves not to exceed 15 miles for pipeline segments that could affect HCAs and 20 miles for pipeline segments that could not affect HCAs. The Applicant is also conducting an Emergency Flow Restricting Device ("EFRD") study to determine if additional remotely activated valves will be installed based on requirements of 49 CFR Part 195.452.

Q. How will the Applicant address potential safety risks to residences located near the CO_2 pipeline?

A. I heard several people at the public meetings express concern with the distance of the proposed pipeline to their homes, schools, or community. It is good that people in South Dakota are pipeline aware and have a healthy respect for pipeline safety. Although pipeline failures are unlikely, the Applicant will implement a damage prevention and public awareness program to protect the public from injury, prevent or mitigate effects on the environment, protect the pipeline from damage, and provide ongoing public awareness.[15]

Q. What are the set-back requirements for CO_2 pipelines?

A. There are no established set-backs or distance requirements in PHMSA's pipeline safety regulations or industry standards, however the required depth of cover may change where pipelines are installed less than 50-feet from certain structures.[16] Pipeline operators

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[14] Direct Testimony of Lawrence Meredith, P.E. on Behalf of SCS Carbon Transport LLC, SCS Carbon Transport LLC
[15] Direct Testimony of James Powell on Behalf of SCS Carbon Transport LLC, SCS Carbon Transport LLC
[16] 49 CFR § 195.210

consider the potential impact of a release and the distance to sensitive areas during design of the pipeline and ongoing integrity management efforts.

III. CO2 PIPELINE PERFORMANCE

Q. How many miles of CO_2 pipelines are in the U.S.?

A. Based on PHMSA annual reporting data, in 2020 there were 5,150 miles of CO_2 pipelines in the U.S. This includes 27 different systems in eleven states; North Dakota, Wyoming, Colorado, Utah, Montana, Kansas, Oklahoma, Texas, New Mexico, Mississippi, and Louisiana. The total miles of CO_2 pipelines that could affect HCAs is 527 miles or approximately 10% of the total.[17]

Q. How long have CO_2 pipelines been in operation in the U.S.?

A. The age varies by system with the earliest reported construction date in the 1950s. CO_2 pipeline construction began in earnest in the 1980's with 2,200 miles constructed in that decade alone.[18] In the U.S., we have over 40 years of significant experience with CO_2 pipelines.

Q. Will the Applicant's pipeline be the largest CO_2 system?

A. By mileage the Applicant's pipeline system will be the longest in the U.S., but there are existing CO_2 pipelines that are larger in diameter and operate at higher pressures. For example, there are 500 miles of 30-inch diameter CO_2 lines in service, and other CO_2 pipelines that operate up to 3,260 pounds per square inch gauge ("psig").[19] The Applicant's maximum diameter of 24 inches and maximum operating pressure of 2,183 psig is well

[17] PHMSA Gas Distribution, Gas Gathering, Gas Transmission, Hazardous Liquids, Liquefied Natural Gas (LNG), and Underground Natural Gas Storage (UNGS) Annual Report Data. https://www.phmsa.dot.gov/data-and-statistics/pipeline/gas-distribution-gas-gathering-gas-transmission-hazardous-liquids
[18] Ibid
[19] Ibid

within the normal range of diameters and operating pressures for CO_2 pipelines.[20]

Q. What is the performance history of CO_2 pipelines in the U.S.?

A. PHMSA publishes data on leaks and spills from regulated pipelines. In the past 20 years there have been a total of 102 leaks or releases from CO_2 pipelines and facilities. This includes pump stations, collection sites, and similar facilities. The number of leaks that occurred on pipeline right-of-way is 37.[21]

Q. How injurious were these CO_2 leaks and releases?

A. None of the CO_2 pipeline leaks or releases resulted in a fatality, injury to the public, impact to wildlife, or water contamination. Only one injury, to a pipeline contractor, has been reported in the past 20 years.[22,23]

Q. Does this data include the widely reported leak in Mississippi?

A. Yes. The Satartia Mississippi release in 2020 is included in the PHMSA data. It has been reported by the pipeline operator that 45 people sought attention at local hospitals with some complaining of long-term effects. However, the PHMSA Failure Investigation Report does not identify any injuries as a direct result of the Satartia release nor any harm to wildlife or water resources.[24]

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[20] Direct Testimony of Lawrence Meredith, P.E. on Behalf of SCS Carbon Transport LLC, SCS Carbon Transport

[21] PHMSA Pipeline Incident Flagged Files, https://www.phmsa.dot.gov/data-and-statistics/pipeline/pipeline-incident-flagged-files

[22] Ibid

[23] Prior to 2002 injuries were reported as "Bodily harm to any person resulting in one or more of the following: (1) Loss of consciousness, (2) Necessity to carry the person from the scene, (3) Necessity for medical treatment, (4) Disability which prevents the discharge of normal duties or the pursuit of normal activities beyond the day of the accident". This definition was replaced by Amdt. 195-75, 67 FR 831 in January 2002 with "Personal injury necessitating hospitalization".

[24] PHMSA Failure investigation Report – Denbury Gulf Coast Pipelines, LLC – Pipeline Rupture/Natural Force Damage, May 26, 2022

IV. SUMMIT SAFETY COMMITMENTS

Q. How does Summit plan to address safety concerns?

A. The Applicant has committed to meet or exceed pipeline design, construction, and operation requirements. For example, the Applicant has committed to inspecting 100% of the pipeline's girth welds during construction, well above the 10% required by code.[25] The Applicant will incorporate greater design factors with an appropriate pipe wall thickness at crossings and above ground facilities.[26]As I testified above, the Applicant will also bury the pipeline deeper than conventional agriculture practices would disturb to reduce the risk of third party damage and implement a fracture control plan.

Q. Will the Applicant inspect the pipeline after it is in operation?

A. Yes, the Applicant is required to develop an integrity management plan for their system. This plan must be in place prior to operation of the pipeline. Detailed requirements are in PHMSA pipeline safety regulations and industry standards.[27] As I testify above, the Applicant will have to conduct a baseline assessment of the pipeline's integrity and re-assess the pipeline's integrity at least every five years. This includes ILI for threats such as corrosion, external damage, cracking, and natural force damage.

Q. Will the Applicant be required to make repairs if the assessments find something?

A. Yes. Assessment results must be analyzed and any anomalies or other features identified during the assessment will be evaluated to determine if they meet PHMSA Integrity Management regulatory thresholds for repair or additional monitoring.[28] Features that

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[25] Direct Testimony of James Powell on Behalf of SCS Carbon Transport LLC, SCS Carbon Transport LLC
[26] Direct Testimony of Lawrence Meredith, P.E. on Behalf of SCS Carbon Transport LLC, SCS Carbon Transport LLC
[27] 49 CFR Part 195.452, Pipeline Integrity Management in High Consequence Areas.
[28] 49 CFR 195.452(h).

meet those thresholds will be scheduled for excavation, examination, and repair in accordance with regulations and industry standards. This schedule can be as short as immediately for severe conditions to months for less injurious conditions.

Q. Are these inspections and repairs reported?

A. Yes. The Applicant is required to report to PHMSA the number of miles assessed each year and the number of repairs completed.[29] These records must be made available to PHMSA during inspections.

Q. Does this conclude your written pre-filed testimony?

A. Yes, it does.

Dated this 2nd day of November 2022.

John Godfrey

John Godfrey

[29] 49 CFR Part 195, Subpart B