From: Rich Palmer [redacted]
Sent: Monday, April 4, 2022 1:29 PM
To: PUC-PUC <PUC@state.sd.us>
Subject: [EXT] Comments on Proposed Summit CO2 Pipeline, Docket HP22-001.

Dear Commissioners,

My name is Richard Palmer. My wife and I are landowners of 160 acres of agricultural farmland in Brown County that the proposed CO2 pipeline from Summit would cross. We inherited this land from my father and mother who were lifetime farmers and lifetime South Dakota residents. I am the first in at least 5 generations of Palmer's that is not a farmer. I became fascinated with chemistry at Ipswich High School, due to my very good high school chemistry teacher. After high school I enrolled at South Dakota School of Mines and Technology where I completed by BS degree in Chemical Engineering in 1982. I have been working as a chemical engineer ever since and this June will complete my 40th year in my field.

Others have pointed out significant concerns, that I share, in the areas of the pipeline permanently affecting land values, affecting farming yields, safety aspects of handling large amounts of high pressure CO2, use of eminent domain for private-for-profit companies, the potential environmental impact of decades to centuries storage of millions of metric tons of CO2 underground, among others.

My comments regard the overall concept of injecting CO2 underground as compared to better alternatives. My industrial experience is not directly in ethanol bio refining, carbon capture, and storage, but the principles of my chemical engineering education and some of my work experience do carry over and have given me additional concerns.

The proposed Summit project will capture the CO2 from the fermentation process of 31 ethanol biorefineries, condense the CO2 to a liquid, pump this liquid hundreds of miles, and then inject it into the earth for permanent storage. The CO2 will be sequestered. The cost of the project in South Dakota is estimated at $785 million ($4.5 billion entire project). I believe the technology is available to do this, but, in my opinion, is a technology that is very susceptible to becoming obsolete in the not-too-distant future.

Since the technical aspect of this project is new to me, I'm trying to quickly catch up and learn what is happening with regards to carbon capture and storage (this technology) or conversion of CO2 into other products. Here's what I've learned so far:

- There's a high level of activity (research) in what is being called the new carbon economy. Some are environmentally motivated, some are economically motivated. Either way, it's a very popular area of research. Carbon is now recognized as something too valuable to waste.[i]

- Much of the research is aimed at converting CO2 into other chemicals or minimizing/eliminating it in the fermentation process. The objective is to close the carbon cycle (not waste it).

- Much of the research is being promoted and supported by the Department of Energy and is being carried out at very technically capable organizations such as MIT, NREL, Stanford, as well as, several private companies.

- The research is well funded; at least in the 10's of millions of dollars. One example: the Department of Energy's APRA-E initiative has one specific program started in 2021, called ECOSynBio which has awarded $35 million to 15 research groups. "Current methods for ethanol production can waste more than a third of the carbon in the feedstock as carbon dioxide in the fermentation step along. …..Preventing the loss of carbon as CO2 during bioconversion, or potentially incorporating

external CO2 into bioconversions, would revolutionize bioprocessing: the yield per unit input would increase greater than 50%."[ii]

- There is an enormous amount of pure CO2 available. One thing unique about ethanol bio refining is the amount and purity of the CO2 by product from the fermentation process; 12 million metric tons annually (Summit application).

If carbon is becoming too costly to waste, I'm questioning why we would take 12 million metric tons per year of quite pure CO2 and inject it into the ground if something better can be done with it.

The best information I have found on this question so far is a paper from the National Renewable Energy Laboratory (NREL) published in February 2022 with a title of: "Beyond Fossil Carbon? Green Electricity is Opening Doors to Low-Emission Alternatives for Making Fuels and Chemicals". In fairness, the article states the jury is still out on whether it is better to sequester CO2 in the ground or to convert it to other forms. But, they also mention it could soon be as cost effective to make some of the most widely used chemicals out of CO2 and green electricity as it is to make them using current petroleum-based methods. Joshua Schaidle, NREL laboratory program manager for the US department of Energy's Office of Fossil Energy and Carbon Management is quoted in the paper saying, "The advancements we are seeing, the activity we are seeing – we will have commercial offerings in the next 5 to 10 years. …..I think there are opportunities to get down to cost competitiveness, especially as you start to consider any low-carbon credits that come along."[iii]

To summarize, there are many research groups at some of the most scientifically talented institutions in our country working on alternatives to injecting CO2 in the ground. Not only are they highly skilled but they are well-funded and highly motivated; both environmentally and economically. The probability of success looks high to me. This suggests that there is a good chance the technology of CO2 capture, liquification, transport, and bury underground will become obsolete in the not-too-distant future. Why wouldn't a bio refinery capture and convert CO2 at their site into products they can sell? An abundant, pure source of CO2 is becoming too valuable to inject into the ground.

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[i] Blog Post, "Changing What's Possible for the New Carbon Economy," Dr. David Babson, Program Director at the US Department of Energy, Advanced Research Projects Agency – Energy (ARPA-E), Sept. 10, 2020.

[ii] US Department of Energy, ECOSynBio ARPA-E Program Description, "Energy and Carbon Optimized Synthesis for the Bioeconomy (ECOSynBio)," May 14, 2021.

[iii] "Beyond Fossil Carbon? Green Electricity is Opening Doors to Low-Emission Alternatives for Making Fuels and Chemicals," Erik F. Ringle, Feb. 23, 2022, National Renewable Energy Laboratory (NREL).