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	**HP22-001** **CURTIS JUNDT** **INITIAL PRE-FILED TESTIMONY IN SUPPORT OF LANDOWNER INTERVENORS**

Q: Please state your name.

A: Curtis Jundt.

Q: Mr. Jundt, can you tell the Commissioners a little bit about your educational background and work background?

A: Forty-one (41) years ago I graduated from NDSU with my engineering degree and prior to that for about four years while going through school I worked for three different consulting engineering firms out on construction inspection putting in water lines and sewer lines across Fargo and in the Burleigh County/ Bismarck area. When I left NDSU with my engineering degree, decided I did not want to be a consultant, so I did get a job that took me back to Bismarck working for the MDU Resources corporation where I spent 15 years there, mostly involved in the pipeline business. For part of my career, I was the guy that you would go to if you wanted to build to or from the interstate pipeline. My last three or four years there I was director of WBI Gas Services where I oversaw the development of shallow gas fields, drilled about a hundred and eighteen shallow gas wells, fracked the dickens out of them and built all the gathering systems and booster stations. I basically developed the master plans including all the project economics and was in charge of project management.

Q: Did you come from an engineering family?

A: I sure do. There are seven of us from different engineering disciplines and professions.

Q: Who was your father?

A: Ray Jundt, he was city engineer of Bismarck until for about 34 years until he retired in April of 93.

Q: And have you been involved in terms of engineering and building energy pipelines before?

A: I have.

Q: Okay, have you been involved in building compressor stations for any energy pipelines?

A: I was part of being more or less the project manager - I had a good team of engineers but yes, the Glen Ullin compressor station injecting into the 42-inch northern border pipeline, the extension from Valley City to Mapleton which involved compression and now serves not only the Fargo area but approximately 12 Million cubic feet per day of natural gas to the Tharaldson Ethanol Plant at Casselton ND and numerous other gas gathering and mainline transmission pipeline projects.

Q: And have you been involved in building and overseeing projects involving energy shutoff valves?

A: Of course, that's all part of the operation maintenance, safety, and control of a high-pressure natural gas pipeline.

Q: And you also have experience with the operation of energy pipelines for gases other than CO2?

A: Like Summit and pretty much all of its team members - Not CO2. Mainly Natural gas – along with other entrained hydrocarbons - that's the world I come from, and I am very passionate about it.

Q: And do you have experience dealing with safety issues relating to energy pipelines?

A: Yes, most of the 15 years of my corporate career I was on the Corporate Safety Committee representing the headquarters in Bismarck and we would hold our meetings in Glendive, MT. I even did Hazmat training. I also had a safety services company in my private business that I retired from seven years ago. Safety is a very big part of my world.

Q: Do you know whether or not there's a difference between natural gas and CO2?

A: Yes, I do.

Q: And what is the difference?

A: Well, I believe the differences are quite stark. Natural gas escaping to the atmosphere is ½ the weight of air and goes up. I know the significant differences are all about the thermal physical properties of natural gas versus CO2 and the laws of gravity. Methane is predominantly 96 percent of our pipeline quality natural gas stream – that nearly ALL Ethanol Plants burn to make the fermenting of corn possible. That Natural Gas stream along with other hydrocarbons has a specific gravity of 0.55 to 0.65 (Ambient Air is 1.0) and if a rupture occurs the escaping Natural Gas goes up until it dissipates in the air. Since we all know full well Natural Gas is combustible you could have a spark that could set it off. The impacted area of a Natural Gas leak remains confined to a relatively small, impacted area. Conversely, CO2 is 1.55 times heavier than ambient air and when a rupture of a 2100+ PSIG 24-inch pipeline occurs, the CO2 goes through a rapid phase change in the pipe moving toward the point of escape going from a supercritical fluid to a fluid then to a dry ice solid as it is emitted to ambient air atmospheric pressure and varying temperatures. At the point of escape, you have what's called an endothermic reaction where the temperature surrounding the ruptured CO2 pipe drops to a cryogenic temperature of minus 109 degrees Fahrenheit or colder so the CO2 is emitted into the air as dry ice particles and will turn any water vapor into ice crystals. Once the escaping cryogenic particle of CO2 warm in the air it quickly sublimes from its solid particle phase and becomes an odorless, colorless gas as it moves low to the ground first filling up low-lying areas as it makes it way to the lowest elevation point – like for Bismarck, ND that would be the Missouri River. That's a very significant difference as CO2 is not combustible but rather is an asphyxiant, giving citizens no sense of smell or vison as it moves across pretty good distances along low-lying areas like water vapor fog. The colder the ambient air temperature and the lighter the wind speed the longer it will take in time and distance for the CO2 to disperse in the air. This is just simple logic. So, depending on whether you would have only a light breeze with the ambient air temperatures - like this last winter where we had days it was 25 below zero or colder - the CO2 plume or cloud will hang lower to the ground and stay dense taking longer to dissipate than if we have warmer ambient air temperatures and stronger winds that would help dissipate a CO2 plume more quickly. Common sense tells you that a CO2 rupture or leak can impact a significant area where natural gas escapes to the atmosphere in the same gaseous pipe phase as it rapidly moves upward into the atmosphere. Having Natural gas transmission and distribution lines in this country for 130 years has provided citizens with a highly beneficial "commodity" we ALL need and benefit from and where we significant safety knowledge and public awareness. Again, if it does ignite, we're talking about an event that is localized to where the rupture is - that's a very significant difference when compared to a supercritical CO2 rupture and leak effecting a large swath of land downwind.

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Q: Let's talk about size and pressure of pipelines and so you have studied the proposed Summit Pipeline application and their engineering information?

A: Generally, yes. Like any pipeline system you've got your gathering lines which I would call those the lines coming from the ethanol plants (or laterals) and then they move to one of several larger diameter trunklines that take the CO2 to the even larger capacity mainline. So you'll maybe have four inch then you'll move to maybe a six or eight inch and it's all about volume until you finally interconnect with the main line that in North Dakota is a 24-inch diameter pipe.

Q: So, what's the difference going to be in terms of the volume of CO2 that will be in a 4-inch pipeline versus a 24-inch main line?

A: So early on I gained an awareness about this project, that was a question that was asked of me almost right away, i.e., what's the difference in capacity between the DGC 8 and 12 inch running up to the Weyburn field and a 24 inch pipeline running through Emmons and Burleigh Counties? A lot of folks thought the 24-inch going to carry three times more than the 8-inch pipe. And I said no just the difference of squares without friction losses the 24-inch will be equivalent to 9.4 8-inch pipes but when you factor in friction loss, you're talking about up to fifteen 8-inch pipes to move about the same volume as a 24-inch will at 2183 PSI. It's significantly different.

Q: Okay and so are you saying you would need fifteen 8-inch pipelines to carry the same amount of CO2 that can be carried in a 24-inch pipeline?

A: That's my opinion yes.

Q: And then what significance does it have that this pipeline is planned to be at a supercritical pressure of 2,183 pounds per square inch?

A: So, I'm very familiar with high pressure pipelines. To reach supercritical phase CO2 has to reach 1070 PSI at 87 degrees. Now there are going to be points along this pipeline where the temperature is probably not going to be 87 degrees the further the CO2 gets away from the discharge end of a compressor station. There can be phase changes along the path of the pipeline as pressure and temperatures change. The planned CO2 pipelines will be well above 1070 PSI so you're going to remain in supercritical phase across a varying temperature range.

Q: When this pipeline is planned to be supercritical is that extremely high pressure?

A: It is. With a 2,183 PSIG maximum allowable operating pressure they may or may not reach that starting out depending on how full the pipe. From what I've heard they intend to fill the pipe to capacity as soon as possible just like any pipeline you intend to maximize your throughput so we have to expect sooner than later they will be running this at 2,183 PSI.

Q: And so, let's talk about a 24-inch pipeline from a shutdown standpoint. How would that happen if there was a leak? What would that shutdown process look like?

A: Well again I can only relate from the natural gas industry, and we are talking about a totally different animal here. We're talking about a baboon and a monkey here, but this is a baboon so if this thing's running at its supercritical maximum pressure, you don't get a lot of wiggle room in shutdown procedures. If you are running a natural gas pipeline at 400 PSI but the allowable pressure in the pipe is 800, you can probably shut your valves quicker because you have 400 PSI to pressure up. So, this in my opinion will have to be an orderly shutdown to prevent a water hammer like effect and catastrophic failure upstream of any rupture, so the downstream valve could shut pretty darn quick; like immediately. According to Mr. Powell's previous testimony in Bismarck on March 14, 2023, the remote telemetry valve actuator can close the valve in about two minutes. I don't believe that's going to be two minutes from the time they sense a pressure drop since there there's going to be an orderly shutdown and I know there's pressure sensors and pipeline protective pressure pop-offs and pressure relief and automatic shut-down on compressor stations. Nevertheless, there's going to be a lag time from the time their SCADA system operator sees a pressure drop anywhere along the 2,100+ mile pipeline route. I don't know if it's going to be tens of minutes or if it is going to be 30 minutes before that upstream valve is shut. I do not believe it's going to be just minutes.

Q. What is this this water hammer effect you refer to?

A. The water hammer effect can happen when CO2 is in a liquid or supercritical phase if they shut the upstream valve too quickly you can have rapid pressure build-up on the pressurized side of that upstream valve before the upstream compressor stations shut down and/or other upstream pressure relief happens. They will be operating this CO2 pipeline at a supercritical fluid phase and it's really not the pure fluid liquid CO2 and it's a gas - it's right in between those two phases where it's very dense and acts like a fluid. If they are going to be at 2,183 PSI the CO2 density will be at potentially 50 pounds per cubic foot or more in that pipe. The nearest compressor would have to shut down immediately so once that shuts down and stops discharging, they can shut the upstream valve upstream of the rupture - so maybe minutes are not unreasonable depending on the response. There's going to be

humans involved in evaluating a pressure drop and then implementing the mitigation procedures. I believe it's unreasonable to think the SCADA control is going to automatically shut down the pipeline without humans involved in evaluating the data and implementing the response.

Q: Okay so where will there be a lag time between when whomever at Summit is monitoring the line and sees a drop in pressure to when they can start the shutdown process?

A: There is lag time, shutoff will not be instantaneous.

Q: Okay and what does that lag time range to and from?

A: It depends on the circumstances like the amount of pressure drop, location, etc. If it is a small pressure drop it could be a faulty pressure sensor where they would need field verification. In that instance they would send a field guy out to verify whether a CO2 leak is occurring, or to see if it is a faulty pressure sensor. One size does not fit all as there can be a multitude of circumstances including faulty readings from the equipment in the field to the SCADA system. Response times will be dependent on the time it takes their field personnel to get out to the site should field verification be needed before the extensive shut-down process commences. And the ability for field verification to happen will be greatly affected by weather conditions during the winter months.

Q: In terms of pipeline, you understand this is a carbon steel pipeline that Summit proposes to install is that correct?

A: Correct.

Q: Okay - and does that type of carbon steel have the same susceptibility to corrosion that a natural gas pipeline does?

A: Yes, it does.

Q: Okay - and so can you explain that?

A: So natural gas we limit four pounds per million cubic foot of water content along with other specifications that must be met by a producer delivering natural gas to the transmission system such as BTU min/max, minimal grains of H2S, 0.4 percent of CO2, limits on other liquid hydrocarbons, etc. Aside from water content, CO2 and H2S are extremely corrosive especially if there's any water vapor content in the pipeline. In a CO2 pipeline where you have near pure CO2 you have considerably high risk when it mixes with water content as it forms carbonic acid that is extremely

corrosive to a carbon steel pipeline. You do not have that carbonic acid risk in a Natural Gas pipeline other than water content can corrode the carbon steel pipe causing iron oxide corrosion like any metal. The biggest thing with controlling water content in the natural gas pipeline through stringent dehydration at compressor stations, is eliminating freeze-off at any point along the pipeline where you have a pressure drop. When the natural gas pipeline delivery pressure drops across the system like into town borders and across valve settings that's an endothermic reaction where the temperature drops significantly and could cause freeze-offs caused by too much water content or liquid hydrocarbon hydrates. So that's why we limit other liquid hydrocarbons also to prevent valves and things like that from freezing up.

Q: So, is CO2 from carbon capture likely to have some water in it?

A: Yes - water vapor is one of the byproducts of natural gas combustion as well as the fermentation process itself. In addition to pulling CO2 off the emission stack of the natural gas combustion, there will be water vapor along with the CO2, Benzene and Formaldehyde coming from the Fermentation process. They'll have to dehydrate after capture at every ethanol plant and it will need to be extremely stringent and critical to monitor to prevent any influx of water inadvertently entering the CO2 pipeline system!

Q: So, if there's some water vapor in the CO2 that goes in the pipeline will that increase the risk of corrosion of the pipeline?

A: Correct. Although they won't have to deal with H2S which is a good thing, they're going to have to be extremely vigilant and I believe even more so than natural gas, because of the fact that any water vapor, or any entrained water in that pipeline combining with CO2 forms carbonic acid compound and it can corrode the pipe very quickly. They'll have to dehydrate this CO2 drier than a popcorn fart; I mean it's going to have to be very dry and I'm sure that's what they're going to do but that's another critical thing that has to be monitored because the carbonic acid can do significant damage to not only the internal pipe but even a weld. Your weakest links are your welds, so the internal corrosion on the internal part of a weld can be a considerable risk.

Q: Do CO2 pipelines operate at higher pressure than natural gas pipelines?

A: Well not necessarily but I believe most Natural Gas transmission pipelines in the U.S. do operate at much lower pressures than 2,000 PSIG. In my experience the highest-pressure natural gas pipeline I've had any experience with is Northern Border Pipeline that is a 1,421 mile long 42-inch natural gas pipeline that runs at

1440 PSIG - that would be the highest-pressure pipeline of any significance that I'm aware of.

Q: Summit says that a CO2 pipeline is as safe as or safer than natural gas pipelines from an engineering perspective. Do you believe that to be true?

A: Absolutely not.

Q: And why not?

A: Well, that has been the defiant position of ALL the companies proposing the now 3,600 miles of high-pressure CO2 pipeline. We're talking about a monkey and a baboon here - they may both be from the monkey family, but they are not the same. These proposed CO2 pipelines are the baboon. I would prefer that the CO2 were combustible. I would prefer that it had the specific gravity of methane (0.55) or even anhydrous ammonia (0.76) along with their other thermophysical properties. Natural Gas is NOT an asphyxiant and will tend to disperse upward and out much faster. We have significant experience with natural gas - we odorize Natural Gas anytime the pipeline runs anywhere near a populated area. We have more than a century of experience with Natural Gas transmission pipelines when they built the first long-haul Natural Gas pipeline a hundred some miles long 130 years ago. Odorization in Natural Gas came years later since, like all things in engineering, we learn and grow from catastrophic or bad incidences. We now odorize natural gas across all distribution systems to industrial, commercial and residential dwellings and at various points along the transmission line route if it runs near High Consequent Areas (HCA's) or populated areas or near high occupant buildings like rural schools. That is a significant safety aspect for Natural Gas Pipelines and a significant difference between CO2 and natural gas transportation overall. You can smell even a small Natural Gas leak anywhere around your home, or in your home, or anywhere along the route where odorization occurs. So, we have 130 years of natural gas pipeline experience and three million miles of transmission, distribution and gas gathering versus 5,150 total miles of CO2 pipelines running in rural unpopulated areas primarily serving the oil industry's Enhanced Oil Recovery (EOR) projects. Again, we're talking about two different animals here from a routing, operational, emergency response, safety and public awareness perspective.

Q: And then in terms of anything that would alert someone there's been a CO2 leak will there be any color any odor to any plume?

A: No, not with any of the proposed pipelines carrying nearly pure CO2 without even a trace of H2S. It's the small trace of H2S in the Denbury pipeline that gave a rotten egg smell during the Sataria, Mississippi CO2 pipeline rupture event. Humans can smell small traces of H2S that are not all that harmful in short exposure instances.

It's when concentrations of H2S go above even a small threshold percent that H2S is odorless and almost immediately deadly. The small trace of H2S in Sataria actually provided a benefit of giving off an odor that citizens first noticed that provided at least some indication there was an issue. Otherwise, the only warning would have been the sound of the high velocity CO2 stream escaping the pipeline at the rupture.

Q: Is there going to be any warning to the public or someone nearby in the event there's a CO2 leak in in terms of odor or color or something like you might have with natural gas where there is an odorant added when running near occupied business and residential areas?

A: No there won't be any odor or visible alert. You will just hear the high velocity jet-like noise of the rupture and it will be extremely audible for miles away; even more so than Sataria where they could hear the jet noise at five miles from the rupture that occurred at a pipeline pressure of 1,402 PSIG versus All these proposed mainline supercritical CO2 pipelines running as high as 2,183 PSIG.

Q: Okay and so in terms of comparing a natural gas versus CO2 pipeline rupture or leak, which leak event is one more lethal or potentially lethal than the other?

A: There is no question in my mind that should a significant CO2 pipeline rupture event occur like the one in Sataria – which was a guillotine rupture where the pipe completely severed, is substantially more lethal than if the same event occurred in a Natural Gas pipeline. This was essentially the consensus of a number of the panelists at the May31 and June 01, 2023, PHMSA Public Rulemaking Hearing in Des Moines, IA.

Q: So, based on the thermal physical properties of CO2 - let's talk about what would happen if a leak occurred based on the physical thermophysical properties of CO2?

A: Okay, so this is where the very sophisticated plume modeling is going to be extremely complex involving literally hundreds of different iterations to adequately access, plan and prepare for the needed Emergency Response. As was discussed on May 31, 2023 in Des Moines, IA at the PHMSA Rule-making Public Hearing, CO2 dispersion (or plume) modeling will extremely complex and hence extremely expensive, albeit extremely necessary to protect human and animal life, due to all the variables (Reference the attached article that appeared in the "Iowa Capital Dispatch" on June 01, 2023: https://iowacapitaldispatch.com/2023/06/01/experts-predicting-co2-pipeline-rupture-threats-can-be-extremely-costly/) . Nevertheless, I can envision what will happen knowing enough about the thermal physical properties of a natural gas stream that may contain small amounts of propane, butane

and CO2, versus a pipeline carrying 98% pure CO2 in a supercritical or dense phase. When the latter erupts it's likely going to be a guillotine break. A guillotine break is when the pipe separates at a weld where you could have the full diameter of the pipe venting at that point versus just a crack or a pinhole. So, in a guillotine break happening in a 24 inch 2100+ PSIG CO2 pipe this is going to blow a large crater around the rupture where the temperature will drop to minus 109 degrees Fahrenheit and colder in an endothermic reaction as the CO2 depressurizes to atmospheric pressure. The supercritical CO2 will change phase quickly in the pipe going to a liquid phase before it enters the cryogenic conditions around the rupture. The venting to atmosphere will be CO2 dry ice solid particles shooting high into the air (the colder the ambient air the higher the jet of solid particles will move upward before warming enough to sublime into the gas phase) and will also crystallize any water vapor in the air. Once the CO2 finally warms enough it will be colorless and odorless falling back to the ground as the CO2 gas is 1.55 times heavier than air. The CO2 plume, or cloud, will move along the ground like water vapor fog filling low-lying areas first as it flows from high to low elevations. The lighter the winds, the colder the ambient air temperatures along with humidity and other atmospheric conditions along with the topography can mean the longer it will take for a CO2 plume to dissipate. A high-pressure supercritical CO2 pipeline cannot be located anywhere near a residence or active business. To suggest 500 feet or anything close to that is an appropriate setback is irresponsible. It gives landowners and citizens minimal response time since a plume of deadly concentrations of CO2 can cover miles given a myriad of detrimental environmental and topographic considerations. It should be thousands of feet!

Q: And these have you seen anything to suggest that Summit is proposing to have CO2 sensors placed in the community tied to some sort of an Emergency Response Alert System?

A: No.

Q: Near this pipeline?

A: No.

Q: And, in your opinion, would it be mandatory to alert the public in the event of a leak?

A: As just one additional critical public response method - Yes. There are many safety and alert mechanisms that should be considered and incorporated that are not needed in oil, refined products, or natural gas pipeline safety protocols. Just because the existing EOR CO2 pipelines – running in mostly all rural desolate areas - haven't needed new any additional public response safety protocols doesn't mean they

aren't needed in this now pending CO2 CCUS pipeline boom being laid upon so many innocent landowners, rural communities, towns and cities. It would have been wise and prudent have to developed additional first-ever public alert and emergency response measures before coming out of the chute selling these high-pressure CO2 pipelines as "significantly safer than any other hazardous liquid or hydrocarbon pipeline."

Q: This idea of a monitoring system that you talked about I think you said it's an idea, right?

A: It's just one idea.

Q: To give people early notice to respond quickly, right?

A: The most optimal early warning notice possible, yes.

Q. And I just want to ask about some pipeline ductility issues. So, have you studied the information in regard to whether or not there's any information showing whether the pipe materials will meet specific ductility requirements?

A. Even though the pipeline meets or exceeds API requirements for a pipeline running a 2,183 PSIG, there is still the risk of ductile fractures, including zipper fractures, in the event of a catastrophic CO2 pipeline rupture. This is due to the endothermic event where you will have cryogenic temperatures at the rupture or break. The faster the high-pressure CO2 velocity is escaping to the atmospheric pressure, the colder the cryogenic temperature will be that can make the carbon steel pipe very brittle. Controlling ductile fractures in a CO2 pipeline is in a whole other realm versus a natural gas pipeline. This is something that Summit's expert Mr. Godfrey's own company has stated on their website.

Q: You talked about the potential for corrosion inside of the pipeline and I think what I heard you say was they just have to be very vigilant to make sure that they don't introduce too much water vapor content into the pipe right?

A: Dehydration will be even more critical than any natural gas line correct no matter what time of year we are talking about

Q: Would you agree that the closer the mainline valves in more populated areas of South Dakota, the better in terms of size and duration and dispersion time of a CO2 plume?

A: Yes, it's all about mitigation of the size and duration of a deadly CO2 plume. The further the valve spacing the more volume and potentially longer you vent; so yes, I would agree. Common sense simply confirms that.

Q: Do you have an opinion then on if there's a greater propensity for issues with the line being above ground - say a thousand feet or thousands of feet spacing increments - with above ground mainline block valves (MLBV's) than if there were fewer above ground valves spaced at a greater distance?

A: It's somewhat of a catch-22 because above ground valve settings add more welds and increase the risk of failure due to many and various circumstances. Those MLBV's in addition to compressor stations, dehydration facilities and other above ground facilities are where you are most susceptible to having a leak or an escape. So, the more above ground valve settings we have, there's going to be more maintenance required. But again, I think the safety that it brings nearby residents far outweighs other considerations. PHMSA's new rulemaking process is addressing this along with many other very crucial design, construction and operational rules all intended for one primary purpose – to keep citizens SAFE!

Q: In your opinion, how long we could expect a full-bore guillotine break on a 24-inch line to blow gas given 10 miles versus 20 miles spacing of mainline block valves?

A: I don't think it's linear – meaning a 20-mile spacing of MLBV's won't necessarily vent twice as long since it's all about velocity of the escaping CO2 over time. It's not probably going to be twice as long but it's probably going to be 1.5 or say, 1.8 or times as long because that higher pressure is going to move that product out really fast and then it'll decline and stop venting when it reaches equilibrium with atmospheric pressure. This is no different with natural gas except during the venting of a natural gas rupture, we don't have a natural gas plume, or cloud, flowing low to the ground over many miles. But I would say look at what Chief Briggs of Satartia, Mississippi has said about the Denbury 24-inch diameter CO2 pipe that vented for several hours with MLBV's spaced at 9.5 miles and occurred at a pipeline pressure of 1402 PSI when it ruptured. For these newly prosed CO2 pipelines, we're talking about potentially 15 to 20 miles at 2,183 PSI so we're talking substantially much greater volume and more hours to blow down or vent the CO2 pipeline to atmosphere. In an event of a CO2 pipeline rupture with varying atmospheric conditions, a CO2 plume could cover a significant area in miles length and width where we could have dangerous CO2 concentrations in the air. We know concentrations of four percent and higher are a problem when we normally breathe 0.03 to 0.05 percent and OSHA says at 0.5% the maximum exposure limit is eight hours. At concentrations of 7% and higher CO2 exposure can be fatal if you are not rescued quickly. I believe you can expect to be exposed to potentially 4% percent

and higher for what could be hours and many thousands of feet from a 24-inch CO2 guillotine pipeline rupture given a myriad of detrimental atmospheric conditions like we experience in North Dakota during the winter months. Within hundreds of feet, even a thousand feet or more, the CO2 concentration could be at a deadly level for a period of time given adverse atmospheric conditions of extremely cold temperatures, lighter winds, high humidity, topography, etc. This is why the dispersion model is so crucial and must include dozens - if not hundreds - of iterations given its proximity to varying population densities.

Dated June 15, 2023

/s/ Curtis Jundt

Curtis Jundt