Dear Members of the Office of Information and Regulatory Affairs:

I am a rural citizen, living out in the beautiful land that we call Iowa—the seventh generation of my family to call this little piece of the earth home… a place that you have never been—the nearest town being a community of around 2000 people—but a place where, should you find yourself traveling through, you would always be welcomed.

I am not speaking here today on behalf of any organization; I am not an employee of any industry (I am an academic by trade), nor am I a member of any environmental group. I share urgent concerns about the safety risks of carbon dioxide pipelines, and I am speaking on behalf of my rural community.

We are personally affected by the proposals for CO2 pipelines that have been planned for Iowa—Summit Carbon Solutions, Navigator Heartland Greenway, and Wolf Carbon Solutions (the path of which is proposed to go through the farm fields and next to the farm houses of neighbors whom my family has known and respected for generations). We are living, on a daily basis, the consequences of changes in federal policy. And, after having engaged in extensive research about both the players involved in this proposed infrastructure build-out—that is to say, the fossil fuel industry and their partners, many of whom you already heard from who wish to "remove all barriers" for unfettered development—and about the hazards posed by the transport of dense-phase, supercritical CO2, I have been organizing with my neighbors to oppose these CO2 pipelines. By organizing, I mean going knocking on the front doors of my neighbors, sitting down at kitchen tables and talking, distributing yard signs to post around homes and agricultural fields, offering meetings that explain the peer-reviewed research (in community centers, libraries, church basements, and even machine sheds—if you know what those are), organizing parades and protests. Showing up at the state capitol again and again. Last year, we posted over 250 names of landowner families along the Wolf Carbon proposed route who are opposed to signing easements—we posted it to the docket in the Iowa Utilities Board, where Wolf's proposal is being weighed. Our opposition covers the entire route—centerline and corridor—for most of two counties. We are democrats, republicans; we are young mothers and great-grandfathers; farmers, workers, teachers, and retired persons. We are motivated by a deep concern for the future of our communities. The changes that the fossil fuel industry needs to make to address the climate crisis are not ones that should put our communities under existential threat.

What is it that motivates us? That is what I wish to share with you. I am not here to tell you information that you already know. I am here to share with you *what we know*—so that you might come to understand why we seek your leadership on this issue and how we are turning to our government and asking you, finally, to put the *people* above the powerful interests of industry.

Let me begin by clarifying a couple of things that we Iowans understand about the dangers of carbon dioxide. I draw principally from the following resources:

- Det Norske Veritas (DNV), "Design and Operation of CO_2 Pipelines: Recommended Practice"[i]

- The UK's Health and Safety Executive, "Assessment of the major hazard potential of carbon dioxide (CO_2)"[ii]
- Compressed Gas Association, "Product Information: Carbon Dioxide"[iii]
- OSHA (Occupational Safety and Health Administration), "Permissible Exposure Limits"[iv]
- ACGIH (American Conference of Governmental Industrial Hygienists), "Carbon Dioxide"[v]

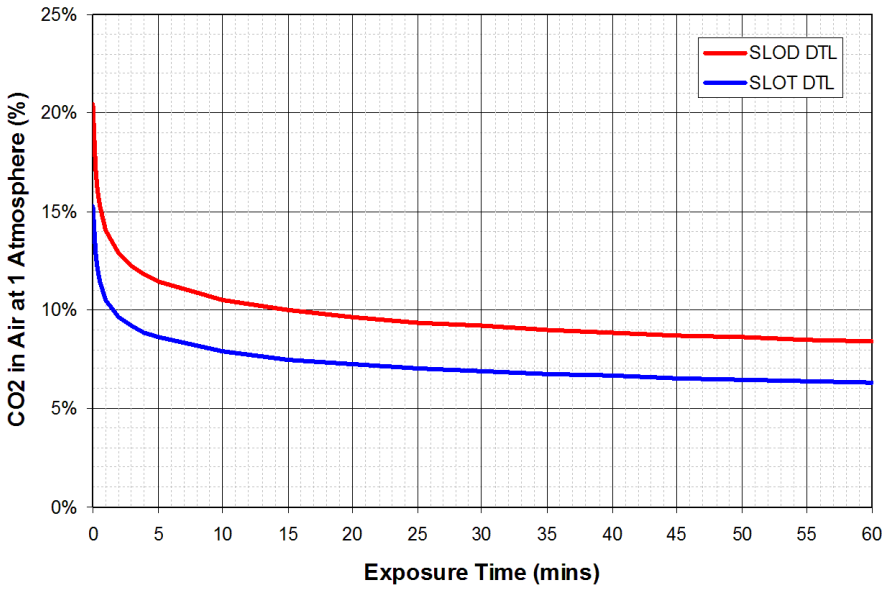
Most of us are well aware of the fact that CO_2 is an asphyxiant. As an asphyxiant, carbon dioxide displaces the normal oxygen that is in the air and can result in unconsciousness or death by suffocation. It's one-and-a-half times heavier than air, so it does not immediately dissipate into the atmosphere when released but tends to gather along the ground, especially in low-lying places like valleys or river-bottoms. Those of us mammals who live on land—that would be, all humans—are at risk, and so are flora and fauna of many kinds, from microbes living within the soil, to the plants on the soil surface, to livestock grazing above.[vi]

But it isn't asphyxiation that, in my judgment, is actually the most terrifying risk posed by carbon dioxide. There's more to it than the displacement of oxygen. The Compressed Gas Association puts it very bluntly: carbon dioxide itself "does not support life and can be dangerous even when adequate oxygen is available." That's because carbon dioxide is not only an asphyxiant; at the cellular level, it is a toxicant, as well. Research confirms that, "it leads to an increased respiratory rate, tachycardia, cardiac arrhythmias and impaired consciousness. Concentrations >10% may cause convulsions, coma and death."[vii] At concentrations of 10% carbon dioxide, there is still enough oxygen in the air—we do not suffocate. But we die.

Many of us have known, ever since I began talking with neighbors about the pipeline projects in 2021, that carbon dioxide plus water equals carbonic acid, but I must admit that not until recently did I come to fully appreciate something about carbon dioxide and the human body—I mean, that so much of the human body is water.[viii] There is a complex and delicate relationship between water, carbon dioxide, and carbonic acid that is ongoing internally, automatic, and vital for human life, since carbon dioxide is a byproduct of energy production at a cellular level.[ix] The UK's Health and Safety Executive writes in their report that, although CO_2 is commonly thought to pose a threat to life as an asphyxiant (and it does, at high levels of concentration), at even relatively low levels of concentration carbon dioxide creates "an immediate threat to life […] due to the toxicological impact it has on the body."[x] They continue:

> The inhalation of elevated concentrations of CO_2 can increase the acidity of the blood triggering adverse effects on the respiratory, cardiovascular and central nervous systems. Depending on the CO_2 concentration inhaled and exposure duration, toxicological symptoms in humans range from headaches (in the order of 3% for 1 hour), increased respiratory and heart rate, dizziness, muscle twitching, confusion, unconsciousness, coma and death (in the order of >15% for 1 minute).

Coma and death within one minute. DNV, the private risk and liability research company based in Oslo, Norway, developed a graph to show how this works—research with which I am sure you are familiar, and which I will be posting to the documents section of your website later today.[xi]



SLOT DTL = Specified Level Of Toxicity Dangerous Toxic Load
SLOD DTL = Significant Likelihood Of Death Dangerous Toxic Load

Along the x axis or horizontal number line of this graph is the amount of time to which you are exposed to carbon dioxide, measured in minutes. Along the y axis or vertical number line is the concentration of carbon dioxide in the air, measured as a percentage. There is a red line that indicates "significant likelihood of death," S-L-O-D, the meaning of which is self-explanatory. For example, at a concentration of 20% carbon dioxide, death would likely be instantaneous. At a concentration of 15% carbon dioxide, death would come within *one* minute (as multiple other resources, like the UK's Health and Safety Executive, have confirmed). At a concentration of just over 10% carbon dioxide (10.5%, to be precise), you would likely die within 10 minutes. If you are asking yourself, "Who would stick around in a plume of carbon dioxide for 10 minutes?" keep in mind that, according to the research, in the 10 minutes leading up to your death, you would likely be experiencing hearing and visual disturbances, difficulty breathing, dizziness, severe muscle twitching, and finally, unconsciousness. Remember, CO_2 affects your brain, your lungs, and your heart. In other words, you would not likely be able to get yourself out. It is also odorless and colorless—you would be unlikely to be able to identify the cause of your symptoms before you were incapacitated. (By the way, unless you have an electric vehicle, car engines will stall out and fail if they are in an area of high CO_2 concentration because combustion engines, too, need oxygen to survive.)

On DNV's graph is also a blue line, labelled SLOT. It stands for "specified level of toxicity." The UK's Health and Safety Executive explains:[xii]

> The DTL [Dangerous Toxic Load] describes the exposure conditions, in terms of airborne concentration and duration of exposure, which would produce a particular level of toxicity in the general population. One level of toxicity used by HSE in relation to the provision of land use planning (LUP) advice is termed the **Specified Level of Toxicity (SLOT)**.

By "land use planning," the HSE means the planning of setbacks from the pipeline route and the prohibition of residential housing or buildings in which people would gather, etc. "Land use planning" is a technical phrase that has important implications in terms of developing the routing of a proposed CO_2 pipeline. And the Health and Safety Executive continues:

> HSE has defined the LUP [land use planning] SLOT as:
> - severe distress to almost everyone in the area
> - substantial fraction of exposed population requiring medical attention
> - some people seriously injured, requiring prolonged treatment
> - highly susceptible people possibly being killed

(Who are the "highly susceptible people," by the way? Those with underlying health difficulties, disabilities, or those who are advanced in age—and this may describe yourself or your neighbor.) According to DNV's graph, then, at concentrations around 7% carbon dioxide, you may experience severe distress, serious injury, or possible death within 15-20 minutes of exposure.

One wonders how scientists determined all of this. Tests—experiments on animals *and* humans, I hate to say (for example, an experiment conducted in 1929 on patients who were "mute and mentally inaccessible," suffering from schizophrenia, bipolar disorder, and major depressive disorder).[xiii] A follow-up experiment from 1959, conducted, once again, on psychiatric patients, confirmed the effects of acidosis on the cardiovascular and respiratory systems.[xiv] Of course, more recently the experiments on unwilling human beings have been stopped, thankfully. But now CO_2 is commonly used to euthanize laboratory rats, a practice that the Animal Welfare Society condemns, noting that, "At higher concentrations, CO_2 turns to carbonic acid upon contact with mucous membranes, eliciting significant pain."[xv] The mucous membranes refer to areas in a mammal's mouth, nose, windpipe, lungs, stomach and intestines. We, too, are mammals. I am reminded, here, of a CO_2 pipeline rupture in Satartia, MS in 2020 and of the victims whom emergency responders found unconscious, in a fetal position, "white foam coming out of their noses and mouths, their clothes stained with urine and excrement."[xvi] Is that what we want for our families, gathered around the dinner table one evening, or one night, sleeping in their own beds?

I do not ask these questions lightly. After three years of meeting with neighbors who, like myself, oppose the build-out of carbon pipelines in Iowa, I know *hundreds* of Iowans who live in the proposed pipeline corridor. And that includes three generations of my own family.

Look, I know that there are carbon pipelines elsewhere in the United States, though they constitute a tiny fraction of the total pipelines in this country. What makes our situation legitimately new and

concerning? I feel that it is genuinely new because the carbon pipelines that do exist are in specific places like North Dakota, Wyoming, New Mexico and West Texas—places whose pattern of rural settlement was quite different, historically, from that in Iowa.[xvii] Of course, there have been accidents in those locations. You know this because PHMSA tracks them. Over a ten-year period, 2011-2021, there were 61 accidents involving the accidental release of carbon dioxide from pipelines.[xviii] That's approximately 1 accident per 82 miles of carbon pipeline in the US. But fortunately, those accidents—with the exception of Satartia—have occurred in areas with extremely low population. For example, on February 10th, 2011, 2530 barrels of carbon dioxide were accidentally leaked near a carbon capture facility built off a lonely stretch of road in eastern New Mexico. (By the way, the PHMSA reports give exact longitude and latitude for the accidents, and so this is how I tracked them on Google maps.) The postal code there, 88410, corresponds to a population density of 0.26 people per square mile. By contrast, the postal code of 52314—where Navigator initially proposed running their carbon pipeline through in my county—has a population density of 99 people per square mile, over 380 times the population of the site in New Mexico. Or take the leak of 2066 barrels carbon dioxide on May 2, 2014, near the Oxy Permian facility in Texas, in country dominated by oil derricks, miles from the nearest habitable structure.

Iowa does not look like that, and that's why the proposed build-out of CO_2 pipelines in our state—as well as other states with similar agricultural history—is a situation quite without precedent. Iowa has been blessed with some of the most fertile soil in the world, and that has meant that settlement of farmers happened in relatively small parcels of land, one quarter-section at a time. And as a result of agricultural abundance, we are gifted with hundreds of small towns that dot our landscape. We may be rural, but this land is far from empty.

That is why the issue of setbacks—the distance between the carbon pipeline and your home, or your child's school, or your small town—is unprecedented in Iowa.

Regarding setbacks, at Navigator's initial public informational meeting in Linn County on December 6, 2021, some of us in the audience asked what a pipeline rupture would look like in terms of carbon dioxide release. Navigator's engineer, Stephen Lee, said he didn't know how much CO_2 would escape in the event of a rupture, but he reassured us that a 25-foot setback from inhabited structures (our homes)—a default setback determined by the area of the right-of-way—was sufficient to mitigate risk.[xix] Mr. Lee said that Navigator might even put the pipeline further than 25 feet from your home or my home or our schools, but he would not commit to a specific minimum distance beyond that of 25 feet.

Assuming that Mr. Lee was professionally competent, we now know that in fact he must have been familiar with the plume dispersion modeling that Navigator had commissioned. He must have known because the route was already developed, and Navigator claims, in their report, "CO_2 Air Dispersion Guidance," that their "routing philosophy" was *guided* by a "buffer distance for each nominal pipe size which applies to residential structures and vulnerable places of gathering."[xx] That distance, they clarify, was based on Hazard Level 4.[xxi] For a 6-inch diameter pipe, the smallest lateral in Navigator's

system, that distance was 321 feet. For a 20-inch diameter pipe, the trunk-line of the network, it was 1,029 feet.

Not 25 feet.

I mention Navigator, specifically, because I was able to obtain their plume dispersion modeling report. What, you may ask, is Hazard Level 4?

6.3 The HGS Hazard Levels are listed below which are ranked from 1 to 4 in increasing severity.

Hazard Level	Published Toxicity Threshold	Exposure	Concentration (ppm)
4	[redacted]	[redacted]	105,000
3	[redacted]	[redacted]	63,000
2	NIOSH IDLH	30 min	40,000
1	ACGIH TLV-Short Term	10 min	30,000

6.4 Hazard Level 1 – Public Awareness: The American Conference of Governmental Industrial Hygienists' ("ACGIH") Threshold Limit Values ("TLV") Short Term 10-minute limit was selected to determine the area where normal breathing could not be sustained without sustaining mild symptoms (such as headaches and dyspnea).

6.5 Hazard Level 2 – Emergency Response: NCO2V shall coordinate with Emergency Response Management and other First Responders whose jurisdictions fall within the boundaries of this Hazard Level. NIOSH defines IDLH as the atmospheric concentration of any toxic, corrosive, or asphyxiant substance that poses an immediate threat to life, could cause irreversible or delayed adverse health effects, or could interfere with an individual's ability to escape from a dangerous atmosphere. The IDLH threshold was selected as the exposure limit where an increased risk is present. This is recognized as an increased risk level as persons might need to evacuate from an IDLH environment via self-evacuation or assisted by first responders.

6.6 Hazard Level 3 – Design & Operations Enhancements: NCO2V will implement additional design and operational measures for Hazard Level 3 and above, where residential structures and areas of public gathering are present within a potential Hazard Area.

6.7 Hazard Level 4 – Initial Routing: NCO2V has implemented guidance for pipeline routing based on Hazard Level 4. The UK HSE criteria for SLOT discussed in section 5.2 is similar to the consequence of the PIR. The PIR is used in natural gas pipeline regulation 49 CFR 192 and is the accepted risk management distance associated with the consequences of a natural gas pipeline explosion. Residential structures should be kept outside the Hazard Level 4 buffer as practicable to mitigate the risk of a worst-case scenario rupture.

The Hazard Levels, 1 through 4, that Navigator developed are based on the toxic effects of the concentration of carbon dioxide in the air. Level 1, at a concentration of 30,000 part-per-million (which, in DNV's terms, is 3%), is the area where, after 10 minutes, "normal breathing could not be sustained." It is also a limit for first responders, by the way. The Compressed Gas Association warns: "Personnel including rescue workers should not enter areas in which the carbon dioxide content exceeds 3% by measurement unless wearing an SCBA or supplied-air respirators."[xxii] In other words, in order for someone to be able to come in and help you evacuate, they have to have access to a self-contained-breathing-apparatus or SCBA, which run upwards of $6000 apiece. Our rural volunteer responders are not adequately equipped. As Jodi Freet, emergency management director of Cedar

County (where Wolf proposes running its carbon pipeline) explained in an interview with the Iowa Capital Dispatch: "I can't send my firefighters or my [emergency medical] people to respond. I have to call in a specialized hazardous materials team," which, she said, comes from a 45-minute drive away.[xxiii] Shelter-in-place, as we recently saw near Sulphur, Louisiana, is the only option for residents.

So that's a Level 1 Hazard—the level where no one can go in and help you except those with special breathing apparatuses. Level 2 is set at 40,000 parts-per-million or 4%, and it is described in Navigator's report as "the atmospheric concentration of any toxic, corrosive, or asphyxiant substance that poses an immediate threat to life, could cause irreversible or delayed adverse health effects, or could interfere with an individual's ability to escape from a dangerous atmosphere." Navigator says that it will coordinate with emergency responders whose jurisdictions fall within the boundaries of this hazard level, and they recognize that "persons might need to evacuate […] via self-evacuation or assisted by first responders" (who, as I pointed out earlier, will need to be wearing self-contained-breathing-apparatuses, which severely limits the number of responders who would be available).

Hazard Level 3 is redacted in the report but corresponds, in the scientific literature, to levels discussed in the UK Health and Safety Executive, "Table 1: Concentration vs. time consequences for CO_2 inhalation."[xxiv]

Table 1: Concentration vs time consequences for CO_2 inhalation

Inhalation exposure time	SLOT: 1-5% Fatalities		SLOD: 50% Fatalities	
	CO_2 Concentration in air*		CO_2 Concentration in air*	
	%	ppm	%	ppm
60 min	6.3%	63 000 ppm	8.4%	84 000 ppm
30 min	6.9%	69 000 ppm	9.2%	92 000 ppm
20 min	7.2%	72 000 ppm	9.6%	96 000 ppm
10 min	7.9%	79 000 ppm	10.5%	105 000 ppm
5 min	8.6%	86 000 ppm	11.5%	115 000 ppm
1 min	10.5%	105 000 ppm	14%	140 000 ppm

Note: * Concentration by volume

The Table specifies SLOT—specified level of toxicity—and SLOD—significant likelihood of death. Navigator's Hazard Level 3 corresponds to 63,000 parts-per-million, or 6.3%, is the level of concentration at which, after being exposed for 60 minutes, the SLOT or specified level of toxicity threshold is crossed. At 105,000 parts-per-million, or Hazard Level 4 (as Navigator is calling it), the SLOT threshold is crossed after 1 minute, and, as you see in the other column, after 10 minutes there is a significant likelihood of death, or SLOD.

Navigator notes that they will "implement additional design and operational measures for Hazard Level 3 and above," (though they do not specify what these might be) and that, "Residential structures should be kept outside the Hazard Level 4 buffer."[xxv]

Those so-called "buffer" zones or setbacks are what the dispersion modeling is all about—the model attempts to determine the distance between the pipeline rupture and those Hazard Levels. *The results of the plume dispersion model are essential information for residents, emergency responders, and other stakeholders in the community. They are not "trade secrets." They are scientific models—science that must be shared with the public.*

7.2 Using the rationale outlined above, NCO2V has summarized the findings from the PHAST and ALOHA modeling efforts below, which illustrates the calculated dispersion buffer (distance) ranges for each Hazard Level and nominal pipe diameter. A detailed summary of the analyses performed, and the associated inputs, can be found in the referenced HGS CO2 Air Dispersion Result documents.

Nominal Pipe Diameter	Hazard Level 4	Hazard Level 3	Hazard Level 2	Hazard Level 1
6"	321'	[redacted]	1,240'	1,971'
8"	417'	[redacted]	1,855'	2,753'
12"	[redacted]	[redacted]	[redacted]	3,291'
16"	[redacted]	[redacted]	[redacted]	3,644'
20"	1,029'	[redacted]	2,920'	4,250'

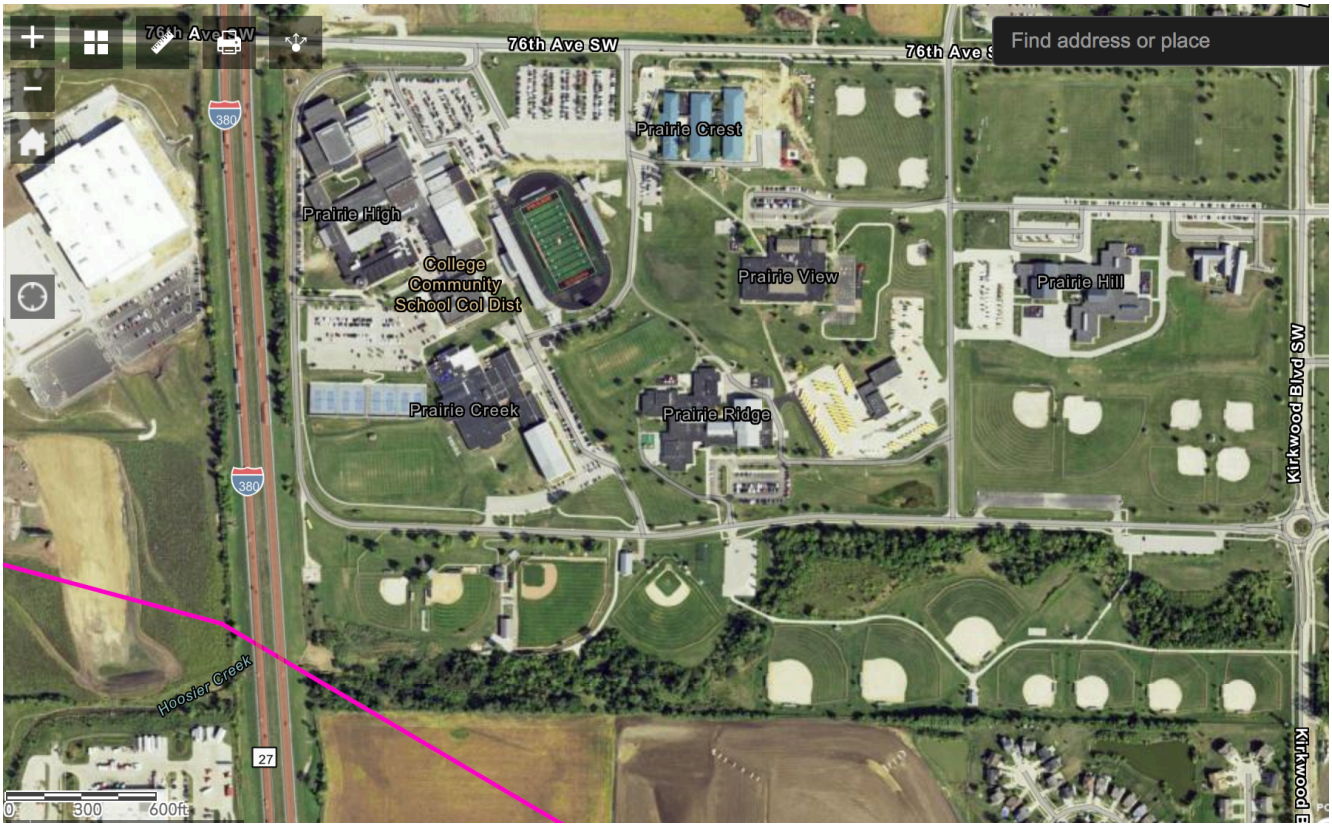
But a word of caution as to the validity of such models. Navigator chose to run reports based on the PHAST and ALOHA protocols, basing their calculations on pipe diameter.[xxvi] ALOHA has not been validated against real-world experiments. This is concerning. And neither ALOHA nor PHAST can account for topography or complex meteorology—because these are not computational fluid dynamics models. It was the PHAST model that failed to predict the consequences of the CO_2 pipeline rupture outside of Satartia, MS. In testimony before the South Dakota Public Utilities Commission, Dr. John Abraham, Professor of Mechanical Engineering at the University of St. Thomas, states:[xxvii]

> Use of the PHAST model does not produce reliable predictions of potential consequences. This conclusion was demonstrated by Denbury's use of PHAST prior to the Satartia rupture. The PHMSA Consent Agreement with Denbury states: "the earlier PHAST dispersion analysis was wrong." To correct this wrong, Denbury agreed to perform a different "overland spread analysis." Attachment 1 at page 5, para. 19. Denbury's use of the PHAST model resulted in Denbury failing to determine that its pipeline "could affect" Satartia. Id. This failure, in turn, resulted in Denbury failure to include Satartia and its first responders in the company's emergency planning and public education efforts. These were real world adverse consequences of reliance on the PHAST model. Prior to the development and widespread use of CFD

> [computational fluid dynamics] modeling, use of PHAST may have been better than nothing, but now there is no reason to use this simplistic model except to limit project expenses.[xxviii]

In other words, the modeling undertaken by Navigator was a less-expensive option that does not provide results that could be deemed reliable because, for example, the type of modelling they employed failed to predict that an impact on Satartia, MS was even possible. In the case of Satartia, this put residents and first responders in harm's way. *PHMSA must learn from this mistake*.

However, as flawed as they are, these are Navigator's results, and they do provide us with perspective on how far these dangerous levels of CO2 can travel—measured in hundreds to thousands of feet, even a mile or more. Companies claims that they can "seal off" or "shut off" a leak or rupture within minutes have, on the ground, been shown to be aspirational rather than reality-based. Most often, as we saw in Satartia and Sulphur, the difference between significant harm or death comes down to the actions of local people—and whether they can sort through the chaos of notification systems for which these companies seem not to be held accountable until proven otherwise. Recall that, in rural areas, first responders with breathing apparatuses might not get to your house until 45 minutes after a pipeline rupture—and that's if they get to *your* house first. And what if there are more than a few houses for them to evacuate?



In my county, Wolf Carbon has routed their pipeline within tens of feet of property belonging to the College Community School District, which is one of those school districts that houses all of the district buildings (Pre-K through 12th grade) on one campus. On any given school day, over 5000

schoolchildren are present on campus—plus staff, teachers, and administrators.[xxix] If a CO_2 pipeline ruptures here, how will first responders, with limited equipment and personnel, be able to get the children out on time?

Moreover, one has to ask: what kind of a company would propose a project like this?

And what about Summit? Well, on October 3rd, 2023, Summit filed its Dispersion Analysis on the Iowa Utilities Board (IUB) docket. Except that they made the *entire* file confidential.[xxx] Indeed, Summit has long argued that the IUB cannot deny or revise any part of their proposed project or route on the basis of safety, nor can the IUB request any documentation regarding safety (according to their claims filed on the docket November 10th, 2022).[xxxi] Also on November 10th, Wolf Carbon filed a brief claiming, specifically, that IUB does not have "jurisdiction to request copies of a pipeline developer's emergency response plan ("ERP"), a risk assessment, and a discharge plume model."[xxxii] And the IUB, bowing to their pressure, upheld these claims, ruling on February 10th, 2023, that the pipeline companies did not need to file a discharge plume model and risk assessment nor emergency response plan.[xxxiii]

Consequently, none of the Iowans who live, work, or go to school within the Hazard Levels identified by dispersion analysis have been allowed to see the report. They have not even been notified about the threat to their safety and lives. Nor have our emergency responders, who are tasked with rescuing them, had a chance to evaluate the information. In fact, the IUB itself has refused to allow Iowans in these hazard zones to participate in the hearing, as intervenors or witnesses. Only those who actually have the pipe going through their property have been accorded that right (although even they haven't been permitted access to the dispersion modeling). This means that there are people who live within a few hundred feet of the proposed route—that is to say, within Hazard Level 4, which means likely unconsciousness within 1 minute and death within 10 minutes—who have not been given access to the information necessary to defend their lives, nor the means to testify before the IUB, participate in discovery, or cross-examine those who have so callously marked them out to carry this burden of risk.

And this was a denial of their rights on a fundamental, human level. *This is why we are turning to you, PHMSA.* Only you have the power to ensure that transparency, science, and accountability dictate policy. We don't want a patchwork of processes across our nation: we want liberty and justice *for all*.

The time to engage all stakeholders with peer-reviewed, scientific information is *before* applying for a pipeline permit. These stakeholders include the EMS leaders and volunteers who, again per PHMSA, need access to dispersion modeling, risk assessment, and ERPs in order to advise in an informed way about the strengths and weaknesses of the proposed route. *Information is the foundation for understanding risk and preparedness*.[xxxiv]

Wolf Carbon Solutions likes to point to their work on the Alberta Carbon Trunk Line as proof of their good intentions here in Iowa. Their CO_2 pipeline in Alberta, Canada is under regulation by the requirements of the Alberta Energy Regulator (AER), which developed "Emergency Preparedness and

Response Requirements" under Directive 071.[xxxv] Directive 071 spells out a very specific process for engaging with the public—*before* developing an ERP (Emergency Response Plan) and applying for AER approval.[xxxvi]

Alberta Energy Regulator

Table 1. When to notify and consult with the public and appropriate authority

Situation	Notification and consultation actions
Developing an ERP requiring AER approval	Notify and consult with the public within the EPZ before submitting an application to the AER for approval. Consult with the appropriate authority and others listed in section 4.2 to confirm and coordinate each party's roles and responsibilities.

The Directive notes that all members of the "public within the EPZ" must be notified and consulted "before submitting an application to the AER." (The "EPZ" or Emergency Planning Zone, the Directive clarifies, is "a geographical area around wells, pipelines, or facilities where the presence of hazardous substances requires specific emergency preparedness."[xxxvii] This would presumably correspond to what we in the USA term, Hazard Levels.) The Directive provides another helpful table to ensure that all stakeholders are either properly notified or notified *and consulted*:[xxxviii]

Table 2. Who to notify or notify and consult within the EPZ

Notify only	Notify and consult
Nonresident landowners and farmers renting land who do not reside on the property but whose lands are within the setback distance as outlined in *Directive 056: Energy Development Applications and Schedules*. These persons must be considered in the development of the ERP and advised that their property lies within an EPZ through an information package sent by a trackable method (e.g., registered mail).	Permanent and part-time residents, including those residing on dead-end roads outside the EPZ but that egress through the EPZ.
Registered trappers, guides, outfitters, and registered grazing lease and allotment users.	Business owners and operators, including oil and gas operators with manned facilities.
Oil and gas operators with unmanned facilities (e.g., wells).	Private and public recreational property owners, operators, and occupants.
Nonresident owners of rented residences whose properties are within the EPZ. Notice is provided in the information package sent by a trackable method (e.g., registered mail).	Rural public facilities and **publicly used developments**, such as schools, community centres, registered campgrounds, and picnic areas.

Notice that permanent and part-time residents, business owners, schools, community centers, etc. *must be consulted before* the company applies to the AER for approval. What does this consultation involve? The Directive says:[xxxix]

15) The duty holder must take the following actions:

a) Conduct in-person consultation with all requisite individuals listed in table 2.

b) Offer to conduct the consultation by telephone if residents do not wish to meet in person.

c) Offer residents a public information package sent by a trackable method (e.g., registered mail) if they do not wish to directly participate in the consultation process; regular mail is acceptable if the resident agrees.

d) Review key incident response information with the public identified in the EPZ who wish to participate in the consultation process to familiarize them with potential emergencies and corresponding **public protection measures** for emergency response procedures. The duty holder's representative is expected to have the necessary knowledge to provide details of the emergency response procedures and address any questions and concerns.

They are required to meet with us—each one of us as individuals! Moreover, the "public information package" that they must provide to stakeholders includes: "identification of the potential hazards associated with the wells, facilities or pipelines," "range of release rates, release volumes […] and EPZ determinations for all wells, pipelines, and facilities," and "a description of potential health effects that could result from exposure"—in other words, precisely the information that fossil industry leaders have argued vehemently to withhold from members of the public who are stakeholders—even our Emergency Management Personnel. Indeed, for their Canadian operations, Wolf was required to engage *personally* on these details with each of the stakeholders identified in Table 2.

But we, in United States Citizens, have been accorded no such respect.

And so, neighbors all across Iowa, are standing together. We will not be silent, and we will not rest until we secure the safety of our communities. We are citizens of a great country, where life, liberty, and the pursuit of happiness are protected under the Constitution. The burden of amassing profits for a private industry that for generations has driven the production of greenhouse gases should not fall on the shoulders of the public. The companies pushing the build-out of new fossil-fuel infrastructure in the form of CO2 pipelines want to take our land, our water—even barter our lives for the billions that they stand to make. But it is clear that they are overlooking a fundamental truth: there is no amount of money capable of purchasing moral character.

PHMSA, now is your moment to demonstrate that moral character.

Sincerely,
Jessica Wiskus

[i] As this report is authored by a private company, DNV maintains the latest edition, 2021, for sale. It is available here: https://www.dnv.com/oilgas/download/dnv-rp-f104-design-and-operation-of-carbon-dioxide-pipelines.html. I have obtained a copy of the 2021 edition myself but cannot make it publicly available. A publicly available version of their earlier edition from 2010 is available here: https://www.ucl.ac.uk/cclp/pdf/RP-J202.pdf. A comparison of the two editions reveals that, although the 2021 version is more extensive, the information presented in the 2010 remains valid. To access DNV's demonstration of a CO_2 pipeline rupture, find the video here: https://brandcentral.dnvgl.com/mars/embed?o=4D2E198D781A6E6F&c=10651&a=N. For a peer-reviewed, scientific report published in July 2021 analyzing this demonstration, among others, see "Risks and Safety of CO_2 Transport via Pipeline": https://www.mdpi.com/1996-1073/14/15/4601.

[ii] See https://www.hse.gov.uk/carboncapture/assets/docs/major-hazard-potential-carbon-dioxide.pdf.

[iii] See https://www.cganet.com/carbon-dioxide-safety/#tab-id-1.

[iv] See https://www.osha.gov/annotated-pels/table-z-1.

[v] See https://www.acgih.org/carbon-dioxide/.

[vi] DNV explains: "Animals exposed to high CO_2 concentrations are assumed to experience the same effects as described for humans." DNV *Recommended Practice*.

[vii] "Carbon Dioxide Poisoning," Nigel J. Langford, in *Toxicological Reviews*, 24, 229-235 (2005). See https://link.springer.com/article/10.2165/00139709-200524040-00003.

[viii] Carbonic acid is especially effective at dissolving limestone, by the way—it is responsible for landscapes called karst (like in Northeast Iowa). It also causes steel to corrode, which is a known risk factor in CO_2 pipeline design—it's why the carbon dioxide must be dehydrated or have the water removed before being transported via pipeline (to avoid the formation of carbonic acid).

[ix] "Physiology, Carbon Dioxide Transport," James Doyle; Jeffrey S. Cooper. Accessed at the NIH National Library of Medicine, National Center for Biotechnology Information. See https://www.ncbi.nlm.nih.gov/books/NBK532988/.

[x] Page 2, the UK's Health and Safety Executive on "Assessment of the major hazard potential of carbon dioxide." The article, "Carbon dioxide poisoning: a literature review of an often forgotten cause of intoxication in the emergency department," Kris Permentier, et al., in *International Journal of Emergency Medicine*, 10: 14 (2017) also confirms that, "In higher concentrations of CO_2, unconsciousness occurred almost instantaneously and respiratory movement ceased in 1 min. After a few minutes of apnea, circulatory arrest was seen. These findings show that the cause of death in breathing high concentrations of CO_2 is not the hypoxia but the intoxication of carbon dioxide." See also https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5380556/#CR13.

[xi] https://www.dnv.com/oilgas/download/dnv-rp-f104-design-and-operation-of-carbon-dioxide-pipelines.html

[xii] See https://www.hse.gov.uk/chemicals/haztox.htm#footref1.

[xiii] See https://mednexus.org/doi/pdf/10.3760/cma.j.issn.0366-6999.1929.06.123.

[xiv] See L. McArdle, "Electrocardiographic Studies during the Inhalation of 30 per cent Carbon Dioxide in Man," *British Journal of Anaesthesia:* 31: 142 (1959). Effects on patients were measured after a mere 5 puffs of the gas (because at 30%, they would otherwise be dead). Acidosis is a decrease in the pH of the blood and can be tied to the conversion of too much CO_2 to carbonic acid.

[xv] See https://awionline.org/awi-quarterly/2015-winter/animals-research-euthanasia-should-not-add-suffering#:~:text=At%20a%20concentration%20just%20one,mucous%20membranes%2C%20eliciting%20significant%20pain.

[xvi] As reported by Dan Zegart in a HuffPost article of August 26, 2021. See https://www.huffpost.com/entry/gassing-satartia-mississippi-co2-

pipeline_n_60ddea9fe4b0ddef8b0ddc8f. We do know that this pipeline rupture involved not "pure" CO_2 but a mixture with H_2S. It is difficult to sort symptoms after the effect.

[xvii] For a current map of CO_2 pipelines in the US, see PHMSA's map: https://www.npms.phmsa.dot.gov/Documents/NPMS_CO2_Pipelines_Map.pdf.

[xviii] See https://www.phmsa.dot.gov/data-and-statistics/pipeline/annual-report-mileage-hazardous-liquid-or-carbon-dioxide-systems. This tiny proportion of pipelines has been responsible for 61 accidents involving the release of CO_2 over the past ten years (2011-2021), as reported to the Pipeline and Hazardous Materials Safety Administration. See https://www.phmsa.dot.gov/data-and-statistics/pipeline/distribution-transmission-gathering-lng-and-liquid-accident-and-incident-data. That's about one accident every 82 miles.

[xix] Meeting discussion recorded by the author of this report.

[xx] See page 7 of Navigator's plume dispersion modeling report, filed on the ICC docket.

[xxi] See page 9 of Navigator's report.

[xxii] See https://www.cganet.com/carbon-dioxide-safety/#tab-id-3.

[xxiii] See https://iowacapitaldispatch.com/2023/06/01/experts-predicting-co2-pipeline-rupture-threats-can-be-extremely-costly/.

[xxiv] Page 3 of UK HSE report.

[xxv] Navigator report, page 9.

[xxvi] An excellent critique of the shortcomings of Navigator's plume dispersion modeling is provided by Dr. John Abraham, who advocates for the use of the more accurate computational fluid dynamics in determining the hazard levels posed by CO_2 pipelines. See his testimony on the docket of the South Dakota Public Utilities Commission: https://puc.sd.gov/commission/dockets/HydrocarbonPipeline/2022/HP22-002/testimony/intervenors/DrJohnAbraham.pdf.

[xxvii] See pages 10-11 of his testimony: https://puc.sd.gov/commission/dockets/HydrocarbonPipeline/2022/HP22-002/testimony/Intervenors/JAbrahamSurrebuttalTest.pdf.

[xxviii] Dr. Abraham further cites the report from PHMSA concerning the accident outside of Satartia, MS by Denbury resources: https://puc.sd.gov/commission/dockets/HydrocarbonPipeline/2022/HP22-002/testimony/Intervenors/JAbrahamAttach1.pdf.

[xxix] See https://www.crprairie.org/district/about-us/.

[xxx] See the posting on the Summit docket, https://wcc.efs.iowa.gov/cs/idcplg?IdcService=GET_FILE&allowInterrupt=1&RevisionSelectionMethod=latest&dDocName=2131515&noSaveAs=1.

[xxxi] See the posting on the Summit docket, https://wcc.efs.iowa.gov/cs/idcplg?IdcService=GET_FILE&allowInterrupt=1&RevisionSelectionMethod=latest&dDocName=2106740&noSaveAs=1.

[xxxii] See Wolf's posting on the Summit docket, https://wcc.efs.iowa.gov/cs/idcplg?IdcService=GET_FILE&allowInterrupt=1&RevisionSelectionMethod=latest&dDocName=2106749&noSaveAs=1.

[xxxiii] See the posting on the Summit docket, https://wcc.efs.iowa.gov/cs/idcplg?IdcService=GET_FILE&allowInterrupt=1&RevisionSelectionMethod=latest&dDocName=2113364&noSaveAs=1.

[xxxiv] It needs to be noted that, in bold letters on their website, the Compressed Gas Association warns: "Do not attempt to remove anyone exposed to high concentrations of carbon dioxide without using proper rescue equipment or the potential rescuer could also become a casualty." And yet, in the moment of an accident in your community, who will be the one to stop our volunteers from going in anyway and trying to save the lives of their neighbors or their own families? See https://www.cganet.com/carbon-dioxide-safety/#tab-id-4.

[xxxv] See https://www.aer.ca/providing-information/by-topic/carbon-capture.
[xxxvi] See page 10, https://static.aer.ca/prd/documents/directives/Directive071.pdf.
[xxxvii] Ibid., page 6.
[xxxviii] Ibid., page 11.
[xxxix] Ibid., page 12.