# **Attachment No. 11**

February 28, 2022

Iowa Chapter
Physicians for Social Responsibility


Sign in Colorado. ---------- *Source: Jeffre Beall*

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# Carbon Capture and Public Health

*By **Sheri Deal-Tyne**, Health & Energy Policy Researcher, PSR Iowa, 2/28/22.*

This series began with **Carbon Capture Basics**, a basic overview of the process of Carbon Capture and Sequestration (CCS) and a brief synopsis of the current debate concerning its promotion. In this second report, we dive deeper into a frequently overlooked issue: the public health implications of CCS. *Read the first report **here**.*

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Anthropogenic, or human-made, CO2 has been a focus of concern for scientists and environmentalists for decades. CO2 makes up about **80%** of total greenhouse gas emissions (methane is next at 10%). The burning of fossil fuels (coal, natural gas, and oil) is the largest source of $CO_2$ emissions.

The UN Intergovernmental Panel on Climate Change (IPCC) released a report in 2018 announcing that $CO_2$ emissions would need to decline 45% from 2010 levels by 2030 and reach "net-zero" by 2050 to avoid a global temperature rise **beyond 1.5°C**. Many in the business and academic communities promote CCS and Carbon Capture and Utilization Sequestration (CCUS) as vital to reaching "net-zero" for the IPCC goal. PSR Iowa feels it is essential to recognize the significant public health risks associated with CCS. This report discusses the hazards accompanying each stage of the CCS process.

In the first stage, the CO2 is captured and separated from other gases, using expensive technology requiring an additional energy source. Capture is proposed at various sites, including coal- and gas-fired power plants and ethanol production facilities. In the second stage, the CO2 is compressed into liquid form, again requiring energy, and then pumped into and transported via pipelines. In the third and final stage, the liquid CO2 is injected into the earth at the sequestration site.

### Lethality of CO2

CO2 is the colorless and odorless gas humans exhale during respiration, contributing to the perception that CO2 is harmless. Concentrated CO2 is an asphyxiant and a recognized **toxicant** cited by OSHA, ACGIH, DOT, and NIOSH. Gaseous CO2 is 1.5 times heavier than air. Liquid CO2 is 10% heavier than water. When released in large quantities as gas or liquid, $CO_2$ settles on the ground, flows downhill, and displaces ambient air.

***Ambient air*** is the air we all breathe. The concentration of $CO_2$ in ambient air is around 400 parts per million (ppm) or 04% but can be elevated in areas with high vehicle traffic or industrial activity. *Atmospheric $CO_2$* is the measurement of $CO_2$ in the earth's atmosphere. Atmospheric $CO_2$ **levels** are tracked by the National Oceanic and Atmospheric Administration (NOAA) and the Scripps Institution of Oceanography.

**Table. Health Effects of Exposure to Elevated CO2 Levels**
– *Information courtesy of Ted Schettler, MD, MPH*

| $CO_2$ concentration | Health Effect | Exposure Time |
|---|---|---|
| 0.04% (Ambient Air) | No Health Effect | Lifetime |
| 2% (20,000 ppm) | Respiratory center stimulated causing increases in breathing (tidal) volume | Rapid |
| 4% (40,000 ppm) | Increases in breathing rate becomes distressing; | Immediately dangerous to life or health (IDLH) [NIOSH] |
| 7-10% | Dimmed sight, sweating, tremor, unconsciousness | After only a few minutes |
| Over 10% | Convulsions, coma, death | Less than a minute |
| Over 20% | Emergency, Loss of consciousness, rapid death | Seconds |

The physiological response to and seriousness of $CO_2$ inhalation varies depending on the concentration of $CO_2$ and the length of exposure time. Conditions from low to moderate exposures are generally reversible when a person is removed from the high $CO_2$ environment.

## $CO_2$ Capture Sites

As the debate about CCS gains momentum, that familiar idiom "can't see the forest for the trees" springs to mind. Proponents of CCS focus on the potential value of removing $CO_2$ from industrial sites while quietly ignoring associated hazards. Combustion of fossil fuels and ethanol production release many pollutants along with $CO_2$. These co-pollutants are associated with a wide range of public health dangers.

Extensive **research** has demonstrated the health hazards of coal-generated electricity. NOx, $SO_2$, mercury, and $PM_{2.5}$ are emitted from coal plants along with $CO_2$. NOx causes airway inflammation, decreased lung function, asthma exacerbation, increased response to allergens, and contributes to particulate matter and ground-level ozone. SO2 causes wheezing, shortness of breath, chest tightness and exacerbates asthma. Continued exposure reduces the ability of the lungs to function. SO2 reacts with water to become acid rain. Mercury is a potent neurotoxin, especially for developing fetuses and young children. $PM_{2.5}$ contributes to premature mortality, increased hospitalizations, cardiovascular disease, bronchitis, cognitive decline, dementia, preterm birth, low birth weight, and congenital disabilities.

**Pollutants** from natural gas-generated electricity include less NOx and fewer particulates, do not include mercury, but do include significant methane leakage. In addition to being a precursor to ground-level ozone formation, and as a greenhouse gas, methane is **much more potent** than CO2.

Note that each stage of CSS technology requires its own energy sources, which generate additional emissions. CO2 capture systems at power-generation plants and ethanol production facilities **also require copious amounts of water** for cooling and other purposes leading to extensive water consumption and increased water pollution, often in areas already facing water scarcity.

### CO2 Transport

Large-scale development of CCS across the US will require the construction of thousands of miles of new pipeline infrastructure impacting ecosystems along their routes. Liquid CO2 is transported in a **highly pressurized state**—higher than natural gas. Additionally, liquid CO2 is corrosive when in contact with water, increasing the risk of leaks, fractures, and ruptures. Rupture of a highly pressurized liquid CO2 pipeline results in an explosive release of an extremely cold (less than -70$^{o}$ C) flood of liquid CO2 that forms ground-hugging clouds of gas and small particles that continue to spread until supply is turned off. Because CO2 displaces oxygen, internal combustion engines would be rendered inoperable near a leak or rupture, interfering with emergency responders. Potential mass casualties would overwhelm rural emergency health systems.

Watch **this video** to see what a CO2 pipeline rupture looks like.

### CO2 Injection Sites

The rollout of CCS projects at the scale required to slow climate change effectively would require establishing CO2 sequestration sites throughout the US. **Estimates** (see pp 18-19) of the storage potential and feasibility are theoretical and vary widely.

The risks of CO2 sequestration **include** leakage of CO2 and increased occurrence of earthquakes like that experienced with high-pressure water injection at fracking sites. CO2 leaks at the surface could damage surface ecosystems or structures, threaten people and animals from high concentrations of CO2, and contribute to greenhouse gas accumulations, all undermining the theoretical value of CCS. Leaks that occur sub-surface could affect drinking water aquifers. Conceivably, using geologic formations as storage for carbon dioxide could compromise deep not-currently-used aquifers on which future generations may depend for drinking water.

### Frontline Communities

**Dr. J.M. Bacon**, Professor of Environmental Sociology at Grinnell College, cautions us to be skeptical of "purely technological fixes when it comes to complex eco-social problems. From an Environmental Justice perspective, the first question is: how have communities been involved at the planning and decision-making stage?"

As has been widely documented, fossil fuel extraction and industrial processes have a legacy of disproportionately impacting Black, Brown, and Indigenous communities. Adding carbon capture to an existing fossil fuel or industrial site functions to extend the lifespan of that facility. Many of the communities already adversely impacted by these facilities would be further harmed by the increased emissions and water pollution associated with carbon capture units.

For example, an industrial corridor that stretches between New Orleans and Baton Rouge, Louisiana is being targeted as a **hub for carbon capture**. This corridor is home to more than 200 oil and gas refineries, petrochemical plants, and other industrial chemical facilities. The area is known as "*Cancer Alley*" because decades of poor air and water quality from industrial pollution have increased cancer rates and other health problems. The **communities** most affected are predominantly Black.

The White House Environmental Justice Advisory Council (WHEJAC) Final Recommendations on climate and environmental justice include a list of "EXAMPLES OF THE TYPES OF PROJECTS THAT WILL NOT BENEFIT A COMMUNITY" (**see page 59**). Number 2 on the list is CCS or CCUS. It is also essential to note that number 1 on the list is "Fossil fuel procurement, development, and infrastructure repair that would in any way extend lifespan or production capacity, transmission system investments to facilitate fossil-fired generation or any related subsidy."

**History lessons: Satartia**

In 2020, a CO2 pipeline in Satartia, MS ruptured, sending 49 people to the hospital and leaving many with long-term health impacts. More than 250 people required evacuation. First responders needed self-contained breathing apparatuses to conduct their rescues. Residents' cars ceased to run, and victims were found dazed or even unconscious. See the full story **here**.

The Satartia pipeline rupture. Source: [Yazoo County Emergency Management Agency]

### Conclusion

Superficially, the potential $CO_2$ reduction associated with CCS projects seems desirable. However, CCS technology and associated pipeline infrastructure are economically costly and come with a significant set of public health hazards. We can achieve *more* $CO_2$ reduction *and* eliminate pollution and mining and pipeline infrastructure by utilizing existing and accessible renewable energy like wind, solar, efficiency, and other readily scalable and available strategies. It is reckless to spend money on unproven technologies that contribute negligible benefit or, worse, disproportionately impact already disenfranchised communities. If we instead focus funding on renewable energy projects and infrastructure, we avoid the myriad health risks associated with CCS altogether.

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### Dear Reader

Stay tuned for our next installment where we take a much closer look at issues surrounding three proposed CCS projects in Iowa.

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## GLOSSARY

**ACGIH:** American Conference of Governmental Industrial Hygienists

**CCS:** Carbon capture and storage/sequestration—The process of capturing human-made $CO_2$ at its source and storing it to prevent its release into the atmosphere.

**CCUS:** Carbon capture, utilization, and storage/sequestration—captured CO2 is utilized in some way, typically for enhanced oil recovery.

**Co-pollutant:** Other types of pollutants that are generated during the burning of fossil fuels, along with CO2

**DOT**: Department of Transportation

**Net-zero**: A nebulous term promoted by some meaning an overall balance between emissions produced and emissions taken out of the atmosphere. Net-zero often replaces the term *carbon neutral*. To save our climate and health, we need to go beyond net-zero to zero production of carbon emissions.

**NIOSH**: National Institute of Occupational Safety and Health

**NOx:** Nitrogen oxide, a co-pollutant of fossil fuel combustion and potent greenhouse gas.

**OSHA:** Occupational Safety and Health Administration

**Ozone:** A co-pollutant of fossil fuel combustion, also known as "smog." Ozone attacks lung tissue by reacting chemically with it.

**$PM_{2.5}$:** Particulate matter, fine particles of toxic pollutants 2.5 microns or smaller in size. Such small particulates are dangerous because they can get into the lungs' alveoli, cross into the bloodstream, and lodge in internal organs.

**Respiratory acidosis:** A condition that occurs when there is an accumulation of CO2 in body fluids that causes acidic conditions that can lead to death.

**Sequestration**: In context to CCS, sequestration is the storing of CO2 in underground geologic formations.

**SO2**: Sulphur dioxide, a highly toxic co-pollutant resulting from fossil fuel combustion.

**WHEJAC**: White House Environmental Justice Advisory Council

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## FURTHER READING

Alexander, Chloe and Stanley, Anna. 2021. "The Colonialism of Carbon Capture and Storage in Alberta's Tar Sands." *Environment and Planning E: Nature and Space*. **https://journals.sagepub.com/doi/full/10.1177/25148486211052875**

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Sokol, Karen C., Verchick, Robert R. M., and Flores, David. 2021. "The False Promise of Carbon Capture as a Climate Solution in Louisiana and Beyond." *Center for Progressive*

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