CARBON CAPTURE COALITION

To: Carbon Capture Coalition Members
From: Carbon Capture Coalition
Date: 03/27/2024
Time: 12-1PM EST
RE: Carbon Storage 101: **Media Briefing Talking Points**

## How Does Geologic Storage of Captured Carbon Dioxide ($CO_2$) Work?

**Topline:**
$CO_2$ is injected and safely and permanently stored deep underground into appropriate rock formations. Storage occurs about 1 mile (1600 meters) below the earth's surface, far beneath underground sources of drinking water.

**Proof points:**

- Suitable storage locations are **separated from underground drinking water sources and occur below impermeable rock layers**, ensuring the $CO_2$ is permanently trapped in the target geologic formation.
- Captured $CO_2$ is injected underground in high pressure and temperature conditions, also known as supercritical form.
    - $CO_2$ in a supercritical form exhibits both the characteristics of a liquid and a gas, having a lower viscosity like gas and higher density like a liquid.
- Supercritical $CO_2$ can be stored in many types of underground geologic formations, including saline formations and oil and natural gas reservoirs. $CO_2$ is not stored in a gaseous state in caverns or caves.
- Both enhanced oil recovery (EOR) and geologic storage in saline aquifers involve the injection of $CO_2$ into the target sub-surface rock formation, where permanent geologic storage occurs. The primary purpose of EOR is to produce additional oil and gas from existing wells. In contrast, the primary purpose of storage in saline aquifers is permanent storage of captured $CO_2$ to address emissions.

## Carbon Storage is Safe

**Topline:**
Large-scale geologic storage of $CO_2$ is a well-understood and mature commercial practice with an excellent safety record.

**Proof Points:**

- The US has over 50 years of commercial experience safely capturing, transporting, reusing, and storing $CO_2$ at a large scale since projects began in the 1970s through enhanced oil recovery (EOR) and more recently through storage in appropriate saline aquifers.
- In addition to commercial experience in the US, the US Department of Energy (DOE) has been studying and field-testing geologic storage for over 20 years.
    - Their work has overwhelmingly demonstrated that geologic storage of $CO_2$ is a safe and permanent practice with a very low risk of $CO_2$ migrating outside the target formation when properly sited and carried out.
    - **No DOE-supported storage project has "observed migration of $CO_2$" outside the intended storage formation.**
- The longest operating $CO_2$ storage facility, the Sleipner carbon capture and storage project operating offshore of Norway in the North Sea, has safely and permanently stored about 1 million metric tons of $CO_2$ annually since storage operations began in 1996.
- Before potential storage sites can move forward, they must provide highly detailed models to federal or state regulators that demonstrate safe and permanent storage of $CO_2$ and ensure the pipelines around sites are continually monitored. This process is well understood.
- $CO_2$ storage risks are well understood, decrease over time, and can be mitigated with best practices and by adhering to regulatory standards. The IPCC's Synthesis Report for the Sixth Assessment states, "If the geological storage site is appropriately selected and managed, it is estimated that the $CO_2$ can be permanently isolated from the atmosphere."
- While the subsurface storage of $CO_2$ can spread over a wide area, injection has a relatively small physical footprint at the surface during the injection phase. For example, the ADM Class VI Well in Decatur, IL, has the capacity to inject over 1 million tons of $CO_2$ per year with a surface footprint of 200 feet by 150 feet.

## Why Do We Need Geologic Carbon Storage?

**Topline:**
While commercially practiced today, scaling up the development and responsible permitting of secure geologic storage at a billion-ton scale is key to enabling industries to reach net zero emissions targets and midcentury climate goals.

**Proof points:**

- Geologic storage is an integral component of the full suite of carbon management technologies, providing durable storage for $CO_2$ removed from the atmosphere or captured from industrial and power facilities.
- Today, 14 commercial-scale projects are operating in the US, capable of capturing and storing 21.4 million metric tons of $CO_2$ per year.
- The IEA's Net Zero Emissions by 2050 Scenario estimates that the current slate of projects under development globally will capture and store about 40 million tons of $CO_2$ in the next five years. To reach net zero, that number must increase to 1.6 billion metric tons by 2030 and 7.6 billion metric tons by midcentury.
- According to DOE, the country's geologic storage capacity is anywhere from 2.2 trillion to 21.2 trillion metric tons of $CO_2$. While carbon management technologies must be deployed alongside a full complement of emissions reduction strategies, the United States' geology alone can permanently store thousands of years' worth of US emissions.
- According to the Global CCS Institute's 2023 Annual Report, since 2022, "198 new facilities have been added to the development pipeline, bringing the current total to 41 projects in operation, 26 under construction, and 325 in advanced and early development."

    - Saline geologic formations are essential to successfully deploying carbon management technologies at the rate and scale necessary to meet US and global climate goals. Even with complementary efforts of nascent carbon utilization technologies, safe, permanent, and well-regulated storage of captured $CO_2$ is a critical tool the US and the rest of the world must deploy to help mitigate the worst impacts of our changing climate.

## Who Regulates Carbon Storage?

**Topline:**
Federal and state regulatory authorities are central to ensuring safe and permanent geologic storage in saline formations through a robust system of monitoring, verification, and reporting. This process is overseen by the US Environmental Protection Agency's (EPA) Underground Injection Control (UIC) Program for Class VI injection wells or by states that have been delegated primary enforcement authority – or primacy – over Class VI wells.

**Proof Points:**

- Ultimately, geologic storage requires successfully obtaining a Class VI well permit from state or federal permitting authorities. The EPA regulates and permits geologic storage projects using the Underground Injection Control (UIC) Class VI Well Program. The UIC Class VI well requirements are designed to protect public health and underground sources of drinking water and ensure that geology in the project area can receive and permanently store injected $CO_2$.
- **Class VI wells** are used to inject $CO_2$ into deep geologic formations solely to permanently store captured $CO_2$, which is often referred to as dedicated storage. EPA established this well class separately from Class II to provide specific regulations for projects where the purpose is dedicated geologic storage. EPA tailored Class VI program rules to address the permanent storage of $CO_2$ and ensure that wells are appropriately sited, constructed, tested, monitored, funded, and closed once injection activities are completed.
    - To date, the EPA has permitted four Class VI wells, with draft permits for four additional wells pending. With the influx of project announcements over the last several years as a result of robust federal investment, as of mid-March 2024, 130 individual well permit applications for 44 projects are currently pending at EPA.
- Class II wells are used to inject fluids (e.g., $CO_2$ and wastewater) associated with oil and natural gas production. Geologic storage of $CO_2$ in such operations can be incidental, meaning that permanent storage of $CO_2$ can occur in the context of injection undertaken principally for other commercial purposes.
    - While the carbon management industry has historically been focused on using Class II wells to store captured $CO_2$, thanks to the incentive structure in place now under 45Q, most recently announced carbon capture and direct air capture projects intend to store captured $CO_2$ in saline geologic formations, which are categorized as Class VI wells.
- EPA has delegated primary enforcement authority for Class VI wells to three states: North Dakota, Wyoming, and most recently Louisiana. Arizona, West Virginia, and Texas are listed as being in the "pre-application" phase. Once states receive primacy, the EPA oversees primacy programs through regular communications with state permitting agencies.
    - **Wyoming** has issued three Class VI permits, denied one permit, and has six additional permits under review, all for the same project.
    - **North Dakota** has approved six permits.

    - **Louisiana** currently has 58 wells under review for 24 projects.
- **Community engagement:** As part of the state or federal Class VI well permitting process, there are specific points for public notice and comment.
    - One way carbon management project developers can ensure transparency and open dialogue is by actively involving local communities early in the decision-making process and allowing for community input to be incorporated early in the project development process. This approach fosters a trusted environment, enhances public and community buy-in, and promotes the formation of valued partnerships. Moreover, a transparent yet timely community engagement process leads to the identification of alternative designs that mitigate local impact and ultimately leads to better project planning.
- To ensure the effectiveness of carbon capture and storage projects, it is crucial that the review of state primacy and individual well applications occurs within a reasonable and predictable timeframe, providing the necessary certainty to encourage necessary private investment.
- Moving forward, EPA regulators must appropriately consider the significant number of well applications, as well as the anticipated influx of state primacy applications. The task in front of the EPA is not insignificant, and interest in Class VI wells is expected to continue to increase as key industries and facilities consider the role that carbon management technologies must play in meeting net zero emissions targets. To that end, it is crucial that the review of state primacy and individual well applications occurs within a reasonable and predictable timeframe, providing the necessary certainty to encourage the robust private investment needed to catalyze project deployment.

## What Federal Support is Available to Scale Geologic Storage Opportunities?

**Topline:**
Commercial interest in carbon management technologies is growing rapidly thanks to robust and bipartisan federal support for economywide deployment of these climate-essential technologies, including the historic investments made in the Bipartisan Infrastructure Law (BIL) and the essential enhancements to the federal Section 45Q tax credit enacted in 2022.

**45Q:**

- To claim the Section 45Q tax credit, taxpayers must successfully demonstrate secure geologic storage of captured or utilized $CO_2$. This occurs through robust and transparent monitoring, reporting, and verification (MRV), or lifecycle analysis (LCA), of the reused carbon through processes established by the Treasury and the Internal Revenue Service and overseen by the US Environmental Protection Agency and DOE.
- The Inflation Reduction Act (IRA) increased the tax credits for both $CO_2$ captured and stored from industry, power, and direct air capture (DAC) projects. Thanks to the incentive structure, interest in storing $CO_2$ in saline aquifers has increased exponentially, with more than 60 percent of announced capture projects from industry and power, as well as direct air capture projects, intending to store $CO_2$ permanently in appropriate geologic formations.

**Figure 1: 45Q Tax Credit Structure and Eligibility Requirements as Amended by the Inflation Reduction Act of 2022**

| | **Annual Carbon Capture Thresholds** (metric tons of $CO_2$/CO per year) | Credit value for secure storage of $CO_2$ **in saline or other geologic formations** | Credit value for **carbon reuse projects** to convert CO or $CO_2$ into useful products (e.g. fuels, chemicals, products) | Credit value for secure geologic storage of $CO_2$ **in oil and gas fields** |
|---|---|---|---|---|
| **Direct Air Capture Facilities** | 1,000 or more | $180 per ton | $130 per ton | $130 per ton |
| **Industrial Facilities** (e.g. ethanol, steel, cement, and chemicals) | 12,500 or more | $85 per ton | $60 per ton | $60 per ton |
| **Electric Generating Units** (e.g. coal, natural gas and biomass-fired powered plants) | 18,750 or more | $85 per ton | $60 per ton | $60 per ton |

**DOE funding:**

- The US DOE National Energy Technology Laboratory-led Carbon Storage Assurance Facility Enterprise (CarbonSAFE) Initiative began in 2016 to facilitate the development of commercial-scale carbon storage facilities, each with the capacity to store more than 50 million metric tons of $CO_2$.
- The vision of CarbonSAFE is to understand the development of a carbon storage complex from feasibility studies until the point of commercial injection, funding has been made available for four different phases of project development and maturity.

- As of September 2023, the CarbonSAFE Initiative has funded 24 projects and is currently negotiating 20 additional projects around the country to address key gaps on the critical path toward commercial carbon storage deployment.
- Separate from annual base appropriations, the BIL provides $2.5 billion for Carbon Storage Validation and Testing, which will build on the development of the CarbonSAFE initiative's Phase II, III and IV projects. The Carbon Storage Validation and Testing program awarded around $242 million in May 2023 to nine projects and around $444 million in November 2023 on the second round to 16 projects.

## What Else is Needed to Scale Domestic Geologic Storage Opportunities?

**Topline:**
To attain geologic storage on the needed scale, Congress must address remaining gaps in federal carbon management remain to build sufficient market demand for this broad suite of technologies. Policymakers across the government must also work with federal agencies to provide the necessary regulatory framework and ensure swift and effective implementation of enacted legislation to allow storage to move forward at the scale necessary to mitigate the worst impacts of climate change.

**Proof Points:**

- Clarifying what agencies are responsible for pore space stewardship and when they have decision-making authority on whether to consider project applications is crucial to creating certainty for carbon management project investors.
- **$CO_2$ Storage on Federal Lands:** Under the Bipartisan Infrastructure Law (BIL), Congress clarified that agencies associated with the management of federal lands have the authority to consider applications for permanent $CO_2$ storage in pore space overlayed by these federally managed lands. Furthermore, this clarification included a requirement that federal land management agencies promulgate rules to provide a regulatory framework for considering applications for leases and easements for $CO_2$ storage on federal lands.
    - To that end, the US Forest Service (USFS) proposed a rule in 2023, Land Uses; Special Uses; Carbon Capture and Storage Exemption. The proposed rule would allow the agency to consider and review applications for the safe and permanent storage of captured $CO_2$ in pore space overlayed by USFS-managed lands.
    - The rule does not approve or allow for the construction of any projects until project developers comply with all applicable federal regulations at both the USFS and the EPA.
    - As part of this review, agencies will have determined that proposed $CO_2$ storage projects do not present a significant health risk to nearby communities or the environment.
    - The Carbon Capture Coalition supported the proposed rule in its comments to the agency. If properly sited and implemented in a manner that protects public access and benefits and minimizes surface disturbance, the geologic storage of $CO_2$ beneath federal lands offers a significant opportunity to catalyze a domestic carbon management industry consistent with reaching midcentury climate obligations.
    - Clarifying regulatory procedures is critical to providing developers access to domestic $CO_2$ storage capacity that aligns with 2050 greenhouse gas emissions targets and anticipated demand for appropriate $CO_2$ storage over the coming years.
- **Offshore $CO_2$ Storage:** The BIL gave the Secretary of the Interior the authority to grant a lease, easement, or right-of-way on the Outer Continental Shelf (OCS) for long-term sequestration of carbon dioxide that would otherwise go into the atmosphere and contribute to further climate change.

    - The law set out a one-year timeframe for DOI to promulgate regulations. The Bureau of Ocean Energy Management (BOEM) and the Bureau of Safety and Environmental Enforcement (BSEE) are working together to draft regulations for public comment.
    - The Coalition anticipates the notice of proposed rulemaking later this year.
    - The potential offshore capacity for offshore $CO_2$ storage is immense. There is the capacity for more than 36 trillion metric tons of $CO_2$ to be stored offshore under the seabed of US waters alone.
    - The Department of Energy's National Energy Technology Laboratory has estimated that the Gulf of Mexico and Atlantic coastal regions each have the capacity to store on the order of hundreds of billions of tons of $CO_2$.
- **Permitting Class VI well applications:** Congress must allocate sufficient resources to federal and state agencies for the permitting and siting process, including robust stakeholder engagement and up-front planning, which yields several important benefits. An effective process allows agency staff to better analyze the environmental impacts of projects and potential alternative designs that utilize all options to avoid, reduce, and/or offset environmental impact in a timely manner.
- **Timely review of Class VI Well & primacy applications:** To ensure the effectiveness of carbon capture and storage projects, it is crucial that the review of state primacy and individual well applications occurs within a reasonable and predictable timeframe, providing the necessary certainty to encourage necessary private investment.

## $CO_2$ Pipelines are Safe

**Topline:**

Transporting $CO_2$ is a commercial activity today. $CO_2$ pipelines have operated safely in the United States for over 50 years. Currently, 50 operating pipelines span over 5,000 miles, with individual pipelines safely transporting millions of metric tons of $CO_2$ annually over hundreds of miles and across entire regions of the country. These pipelines have an excellent safety record.

**Proof points:**

- $CO_2$ pipelines are the safest, most energy efficient and least emissions intensive way to transport $CO_2$ to appropriate sites for geologic storage. Additional modes of transport for $CO_2$ include cargo ships, rail, and trucks as a demand-flexible solution for $CO_2$ transport from capture sites with too little volume to warrant dedicated pipelines, or as pipeline systems scale.
- Safety data reported by the Pipeline and Hazardous Materials Safety Administration (PHMSA), the agency charged with overseeing $CO_2$ pipeline safety, shows that $CO_2$ pipelines have been and can be operated at the highest level of safety by best-practice operators.
- Since reporting began, $CO_2$ pipelines have had a strong safety record, though a rare, but serious pipeline failure in Satartia, Mississippi in 2020 has increased public and policymaker concerns about pipeline safety and the overall reliability of these systems as they scale.
- The US Department of Transportation (DOT) has regulated the safety of $CO_2$ pipelines since the Hazardous Liquid Pipeline Act of 1979. PHMSA was established in 2004 as an agency within the US Department of Transportation and currently oversees $CO_2$ pipeline safety. Under current statute, there are multiple steps that $CO_2$ pipeline operators must take to ensure pipelines are operated safely.
- In 2022, PHMSA released the incident report for the 2020 pipeline failure in Satartia, Mississippi, which provided insights into probable operator violations that led to the rupture. Along with the report, the agency announced several additional measures to ensure that the further build-out of $CO_2$ transport infrastructure is done to the highest safety standards, including a new rulemaking that will build upon existing comprehensive $CO_2$ pipeline regulations.
- The Carbon Capture Coalition champions common-sense steps to build upon comprehensive existing $CO_2$ pipeline regulations and looks forward to continuing to engage with the agency and bipartisan members of Congress to take steps to support the responsible build-out of these systems.

## Resources on Cabon Storage

### Carbon Capture Coalition:

- Geologic Storage's Role in Scaling Carbon Management
- Coalition Guiding Principles for Permitting
- PHMSA Pipeline Safety Factsheet
- Primer: 45Q Tax Credit for Carbon Capture Projects

### Additional Resources:

- Carbon Management 101
- How EPA's UIC Class VI Regulations Work to Ensure the Protection of Groundwater Resources?
- DOE Storage Safety FAQs
- Depth of Geologic Storage Video