



**PEER-STATE CARBON CAPTURE,
UTILIZATION, AND SEQUESTRATION
REGULATORY REGIMES**

A review of carbon capture, utilization, and
storage legislation, with applicability to Alaska

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Prepared for:
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Prepared by:
Stantec Consulting Services

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Peer-State Carbon Capture, Utilization, and Sequestration Regulatory Regimes

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Peer-State Carbon Capture, Utilization, and Sequestration Regulatory Regimes

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Prepared by:


Signature

Lisel Ballmer

Reviewed by:


Signature

Craig Wilson

Approved by:


Signature

Eric Snelling



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Executive Summary

The State of Alaska Department of Natural Resources has retained Stantec Consulting (Stantec) to undertake an overview and analysis of peer state regulatory frameworks governing carbon capture, utilization, and storage (“CCUS”). This report is designed to help inform decisions by the State of Alaska in considering seeking primacy from the U.S. Environmental Protection Agency (EPA) to permit Class VI underground injection wells for long-term storage of carbon dioxide (CO₂) within Alaska and making public lands available for CCUS.

Carbon capture, utilization, and storage is the process of separating carbon dioxide from exhaust gas streams of industrial processes, collecting and transporting carbon dioxide for storage, with the intent that the carbon dioxide will be utilized for other activities (i.e., enhanced oil recovery) or stored in perpetuity (sequestration). CCUS has been occurring globally for over 40 years, first for use in enhanced oil recovery activities in the United States, and later for sequestration in the Sleipner project in Norway, which has been underway since 1996. Carbon storage – the long-term geological storage of carbon dioxide – is considered an important part of the global effort to reduce the emission of greenhouse gases (“GHGs”) into the atmosphere.

This report describes common issues in CCUS legislation across other states (and a few countries) which should be considered in drafting of new state legislation. This report is meant to be one of many tools for the State to utilize when writing CCUS legislation and discussing state primacy over Class VI underground injection wells.

Most legislations reviewed were initially written around 2010 and were amended throughout the next decade. When amending legislations, states appeared to follow the lead of the two states with Class VI primacy: North Dakota and Wyoming. Slight variations occur with timelines and requirements, but most legislations are similar. Alaska will be able to take note of these similarities and apply it to its unique management of natural resources.



Acronyms / Abbreviations

ADNR	Alaska Department of Natural Resources
AOGCC	Alaska Oil & Gas Conservation Commission
CCUS	Carbon Capture, Utilization, and Sequestration
CO ₂	Carbon Dioxide
EOR	Enhanced Oil Recovery
EPA	Environmental Protection Agency
EU	European Union
GHG	Green House Gases
MMV	Measuring, Monitoring, and Verification
N/A	Not Applicable
NEPA	National Environmental Policy Act
UIC	Underground Injection Control
U.S.C.	United States Code



1 Introduction

This report was prepared by Stantec Consulting (Stantec) for the State of Alaska Department of Natural Resources under contract MA 230000011 CCUS Consulting Services. The purpose of this report is to provide an overview of carbon capture, utilization, and storage (“CCUS”) legislation in other states, with an analysis of their applicability to Alaska.

1.1 Carbon Capture, Transportation, Utilization, and Storage Overview

Carbon capture, utilization, and storage is the process of separating carbon dioxide from exhaust gas streams of industrial processes, collecting and transporting carbon dioxide for utilization for enhanced oil recovery or storage, with the intent that the carbon dioxide will be stored in perpetuity (also known as sequestration). A conceptual diagram of the major activities associated with CCUS is shown in **Figure 1**. There are three main steps in the carbon capture and utilization/storage process:

- Carbon capture
- Carbon transportation
- Carbon storage and utilization

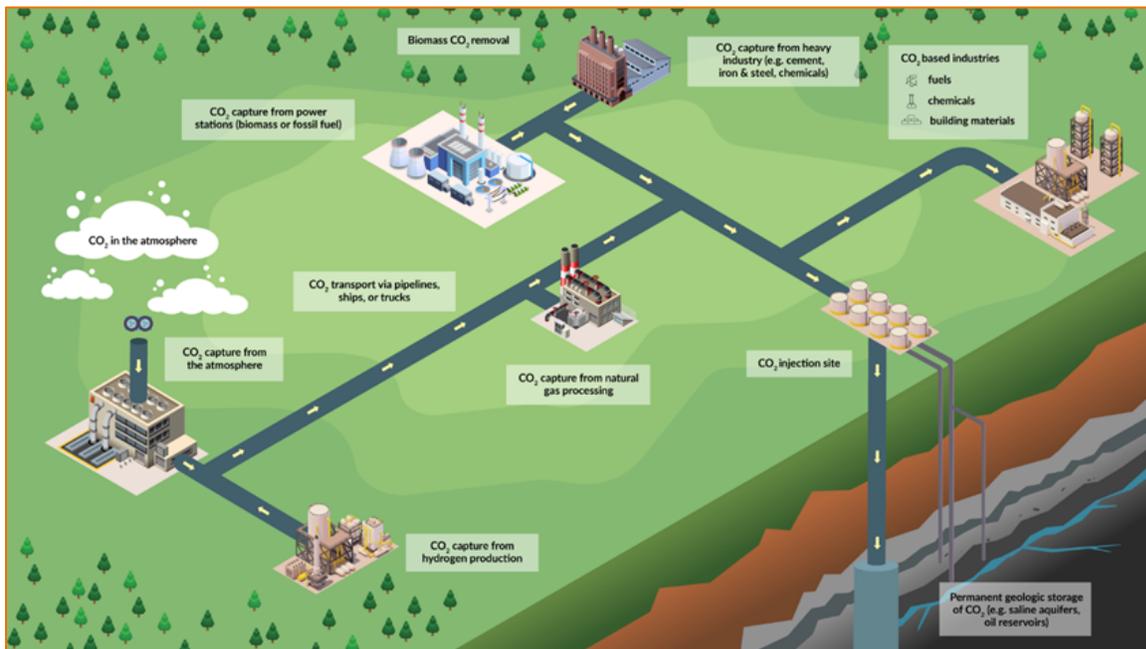


Figure 1 Conceptual Diagram of Carbon Capture and Storage Activities

(NRCan 2021)



1.2 Statement of Need

CCUS projects gives Alaska and the oil and gas industry the opportunity to engage in the growing market of decarbonization. It also gives Alaska another opportunity to lease State land and pore space.

The market of decarbonization and CCUS has gained new interest with the passing of the Infrastructure Investment and Jobs Act and the Inflation Reduction Act in recent years. Both acts have provisions designed to promote CCUS activity. The Infrastructure Investment and Jobs Act appropriated funds for permitting CCUS projects and Inflation Reduction Act increased the Section 45Q federal carbon capture tax credits. Now, there is growing momentum for CCUS, and states must prepare for a new market.

The main two objectives of this legislative effort are to authorize CCUS activity in Alaska and make public lands available for CCUS activities. This report serves as a discussion on legislation closely focused on CCUS from other states and countries.

1.3 History

Established in 1974, the Environmental Protection Agency's ("EPA") Underground Injection Control ("UIC") program regulates construction, operation, permitting, and closure of injection wells used to place fluids underground for storage or disposal. Before 2010, the UIC program covered five classes of injection wells; each well class is based on the type and depth of injection activity and the risk of endangering an underground source of drinking water. Class I, IV, and V wells are used for waste disposal while Class II and III wells are used for resource extraction. In December 2010, the EPA published the Carbon Dioxide (CO₂) Geologic Sequestration Wells Final Rule, making Class VI wells the newest class of injection wells for CCUS.

Class VI wells were established in part due to the success of Class II wells used to store hydrocarbons. Class II wells are primarily permitted for enhanced oil and gas recovery, a process that involves the injection of fluids to retain or increase reservoir pressure and as a result, displace extractable oil and gas. A small number of Class II wells operate as injection wells for the storage of hydrocarbon in underground formations such as salt caverns, or porous geologic material.

Like Class II hydrocarbon storage wells, Class VI wells inject carbon products as a liquid (or as a supercritical fluid) into underground formations. But instead of storing the injected material for later use (as a reserve), Class VI wells are intended to keep the material permanently sequestered.

As of September 2022, there are only two active EPA permitted Class VI wells in the United States. The lack of Class VI permits issued across the United States is partly due to the catch-up time needed by states to develop CCUS legislation to support the UIC program. The delay is also due to a lack of primacy. Primary enforcement authority ("primacy") refers to State, territory, or tribal responsibilities associated with implementing EPA approved UIC programs within that state, territory, or tribe. Delegating Class VI primacy to states from the federal government helps alleviate the EPA's workload. States that do not have the authority to issue Class VI permits rely on the EPA's UIC program for permitting. North



Dakota and Wyoming are currently the only states with Class VI permitting primacy; North Dakota has issued two Class VI permits, with one already active.

Alaska has received primacy to issue Class II well permits within its borders under a Memorandum of Agreement with EPA but has not yet investigated Class VI primacy.

2 Review Methods

This section describes an evaluation of 11 states where CCUS legislation is currently in place: Kansas, Kentucky, Louisiana, Mississippi, Nebraska, North Dakota, Oklahoma, Texas, Utah, West Virginia, and Wyoming. Five applicable international CCUS legislations were also reviewed: Australia, Canada's province of Alberta, the European Union, Norway, and the United Kingdom. The review period lasted from August 2022 to October 2022. Each legislation was reviewed to answer the questions below:

- How does the legislation identify and describe the purpose of geologic sequestration? Does that purpose include references to greenhouse gas emissions?
- How does legislation define carbon sequestration?
- How could this legislation be applicable to Alaska?
- How does the legislation define pore space?
- Does the legislation determine pore space ownership?
- What is the timeline for certification of project completion and release of liability?
- Does the legislation describe penalties for breaking code? Negligence?
- Does the legislation describe carbon credits?
- What is the order of issues addressed? What does the legislation address first?
- Is there a logical flow to the order of issues?

As part of the review, key issues were thematically grouped into categories for easier comprehension. In general, states touched on similar issues but did not use the exact same language in reference to them.

3 Review Outcomes: Themes

The review identified several common regulatory themes, shown in **Table 1** and **Figure 2**. These have been grouped into the eight themes listed below and discussed in more detail in the report.

- Regulatory Purpose and Scope
- Establishment of Authority
- Resource Designation
- Fiscal Support
- Permitting Process
- Liability
- Storage Operations
- Environmental Considerations



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The following report sections expand on how states differ in addressing each of the above themes in their CCUS legislations. The themes are described in **Table 1**. The themes were derived from finding similarities in states' CCUS legislation sections. **Table 2** shows a sample of that process; sections are color-coded to identify themes.

Table 1 Regulatory Themes

Regulatory Purpose and Scope	Refers to the introduction of the CCUS legislation. It describes how the CCUS legislation would benefit the state, therefore communicating what the State prioritizes. It also defines key words in the legislation.
Establishment of Authority	Refers to state's various responsibilities during the permit application process and operations of CCUS injection wells. It also defines which agency in the state will be the authority.
Fiscal Support	Encompasses issues around finances, such as proving financial responsibility, fees, and establishing administrative and trust funds.
Permitting Process	Encompasses all the requirements, provisions, and steps when applying for a CCUS injection well permit.
Resource Designation	Encompasses all the issues regarding ownership over natural resources, such as pore space, carbon dioxide, mineral rights, etc.
Liability	Outlines the liabilities of the CCUS applicant during the application process, operations, and post-operation (long-term).
Storage Operations	Encompasses all the processes involved with a CCUS well after a permit is approved. It covers issues of operation and closure.
Environmental Considerations	Refers to how each state regulates CCUS injection wells to protect the environment, public health and safety, and state resources.



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Table 2 Sample of CCUS Peer-State Regulatory Themes

(In order of appearance and phrasing in legislation)

Wyoming	North Dakota	Texas	Louisiana	Mississippi	Nebraska	Utah	West Virginia
Purpose	Purpose	Purpose	Purpose	Purpose	Purpose	Purpose	Purpose
Definitions	Definitions	Definitions	Definitions	Definitions	Definitions	Definitions	Definitions
Authority Established	Authority Established	Jurisdiction (Authority Established)	Authority Established	Authority Established	Rights (ownership)	Authority Established	Permit Requirements
Regulatory	Permit Requirements	Applicability	Regulatory	Regulatory	Authority Established	Permit Requirement	Public Participation
Enforcement	Permit Hearings	Permitting	Enforcement	Enforcement	Permit Requirements	Hearings	Permit Provisions
Permit Requirements	Permit Consultations	Information required of applicant	Hearings, Rules, Emergency, Public Records	Approval of reservoir	Hearings	Findings to Issue Permit	Add Rule making authority
Permit Hearings	Permit Provisions	Fees	Underground Injection control	Protection of Correlative Rights	UIC Authority	Permit Provisions	Environmental Protection
Permit Consultations	Amalgamating Property Interests	Letter from executive director	Certificate of completion	Unit operation	Rights	Amalgamation of Interests	Other Activities
Permit Provisions	Certificate	Rules	Eminent domain	Permit provisions	Fee	carbon dioxide storage amalgamation unit establishment	Cooperative Agreements
Environmental Protection	Environmental Protection	Consistency with federal requirements	Liability release	Permit hearings	Completion	Requirement record	carbon dioxide ownership
Ownership & Rights	Preservation of rights	Memorandum of understanding		Compliance and enforcement	Penalties	Preservation of rights	Certification of Completion
Fees	Fees	Fiscal responsibility		Storage operations	Trusts	Title	Administration fund
Administration Fees	Administration Fees	Definitions		Fees	Authorization	Certification of Project Completion	Fees
carbon dioxide Trust fund	carbon dioxide Trust fund	Ownership of anthropogenic carbon dioxide		carbon dioxide storage fund		Cooperative Agreements / Contracts	Carbon Credits



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Wyoming	North Dakota	Texas	Louisiana	Mississippi	Nebraska	Utah	West Virginia
Title & Liability	Title to carbon dioxide	Anthropogenic carbon dioxide storage trust fund		Title / Liability		Public Interests	Pore/Container space
Certificate of Project Completion / Release	Certificate of Project Completion / Release	Extraction of carbon dioxide		Cessation of storage operation		Adoption of Procedure	Pore ownership
Oil and Gas conservation Commission	Penalties			Release bond/assurance / deposit		Fees	Funds
Enhanced Recovery	Enhanced Recovery					Trust	Judicial Review
Ownership of materials injected	Cooperative Agreements / Contracts						
Permit Requirements	Trusts/Monopolies						
Unitization of geologic sequestration sites	Participation of Public Interest						
Special revenue account (fees)	Storage Amount						
Administration fund							
Fund post-completion							
Authority							

Regulatory Theme Legend
Storage Regulatory Purpose & Scope
Establishment of Authority
Resource Designation
Fiscal Support
Permitting Process
Liability
Operations
Environmental Considerations



4 Regulatory Purpose

The regulatory purpose justifies the policy by explaining how it will benefit the state. There is an array of purpose statements, highlighting the differing state priorities. Many states have more robust sections than those provided as examples below. States may or may not factor in public health and safety, industrial and commercial interests, natural resources, and greenhouse gas emissions. A summary of regulatory purpose statements is provided in **Table 3**.

Table 3 Regulatory Purpose

State	Purpose Statement
Oklahoma S.B. 610 Section 1.B.1.	“Carbon dioxide is a valuable commodity to the citizens of the State, particularly for its value in enhancing the recovery of oil and gas and for its use in other industrial and commercial processes and applications.”
Mississippi S.B 2723 Section 2. 53-11-3 (1)(f)-(g)	“(f) It is for the public benefit and in the public interest that the maximum amount of the State’s oil and gas reserves be produced to the extent that it is economically and technologically feasible. (g) It is for the public benefit and in the public interest that, to the extent that it is economically and technologically feasible, carbon dioxide be injected into and stored in oil and gas reservoirs and other geologic formations in a manner protective of waters of the State.”
Kansas HB 2419 New sec. 2.b.	“For the purposes of protecting the health, safety and property of the people of the State, and preventing escape of carbon dioxide into the atmosphere and pollution of soil and surface and subsurface water detrimental to public health or to plant, animal and aquatic life, the Commission, on or before July 1, 2008, shall adopt separate and specific rules and legislations establishing requirements, procedures and standards for the safe and secure injection of carbon dioxide and maintenance of underground storage of carbon dioxide.”
North Dakota S.B. 2095 38-22-01	“It is in the public interest to promote the geologic storage of carbon dioxide. Doing so will benefit the State and the global environment by reducing greenhouse gas emissions. Doing so will help ensure the viability of the State’s coal and power industries, to the economic benefit of North Dakota and its citizens. Further, geologic storage of carbon dioxide, a potentially valuable commodity, may allow for its ready availability if needed for commercial, industrial, or other uses, including enhanced recovery of oil, gas, and other minerals. Geologic storage, however, to be practical and effective requires cooperative use of surface and subsurface property interests and the collaboration of property owners. Obtaining consent from all owners may not be feasible, requiring procedures that promote, in a manner fair to all interests, cooperative management, thereby ensuring the maximum use of natural resources.”

4.1 Definitions

How states define key CCUS terms can be important in how legislation is regulated. Most states start by defining the following key words and phrases:

- Anthropogenic carbon dioxide
- Carbon capture, sequestration, and utilization
- Pore space



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- Pore space ownership

The definition(s) of carbon dioxide have potential implications for how CCUS operations may be impacted by current, non CCUS legislations. Captured carbon dioxide could fall under the definition of hazardous, waste, a pollutant, or a commodity depending on the existing, non CCUS legislations in states. Therefore, carbon dioxide may be expanded to multiple definitions (such as carbon dioxide streams, captured carbon dioxide, anthropogenic carbon dioxide) or include many forms.

Several states include the term "anthropogenic" when defining carbon dioxide. Anthropogenic refers to originating in human activity, as opposed to naturally occurring carbon dioxide.

Table 4 Carbon Dioxide Definitions

State	Definition
Alabama 2022 AL S 36 Section 1	"(2) GAS. All natural gas, casinghead gas, carbon oxides, ammonia, hydrogen, nitrogen, noble gases, and occluded natural gas found in coal beds, and all other hydrocarbons not defined as oil in Section 9-17-1(3), except and not including liquid petroleum gas.
Kentucky H.B. 259 Section 1. A. (2)	"Carbon dioxide" means anthropogenic carbon dioxide of sufficient purity and quality as to not compromise the safety and efficiency of the reservoir to securely contain it."
West Virginia H.B. 4491 §22-11B-2 (1)	"Carbon dioxide" means carbon dioxide produced by anthropogenic sources which is of such purity and quality that it will not compromise the safety of geologic storage and will not compromise those properties of a storage reservoir which allow the reservoir to effectively enclose and contain a stored gas."
Mississippi S.B. 2723 53-11-5. (b)(i)	"Carbon dioxide" means: (i) naturally occurring carbon dioxide; (ii) geologically sourced carbon dioxide; (iii) anthropogenic carbon dioxide; or (iv) carbon dioxide stream. The term includes phases of carbon dioxide, whether fluid, liquid or gaseous, stripped, segregated, or divided from any other fluid stream thereof."
Nebraska NE L650	"(2) Carbon dioxide stream means carbon dioxide from anthropogenic sources, plus incidental associated substances derived from the source materials and the production or capture process, and any substances added to the stream to enable or improve the injection process if such substances will not compromise the safety of geologic storage and will not compromise those properties of a storage reservoir which allow the reservoir to effectively enclose and contain the stored carbon dioxide stream;"
Louisiana LAC Title 43, Part XVII §3601	"Carbon Dioxide—naturally occurring, geologically sourced, or anthropogenically sourced carbon dioxide including its derivatives and all mixtures, combinations, and phases, whether liquid or gaseous, stripped, segregated, or divided from any other fluid stream thereof. Carbon Dioxide Stream—the carbon dioxide that has been captured from an emission source (e.g., a power plant), plus incidental associated substances derived from the source materials and the capture process, and any substances added to the stream to enable or improve the injection process. This meaning does not apply to any carbon dioxide stream meeting the definition of a hazardous waste under Title 40, Code of Federal Regulations, Part 261."
Indiana IC 14-39-1-1	"As used in this chapter, "carbon dioxide" means a fluid consisting of more than ninety percent (90%) carbon dioxide molecules."



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“Pore Space” is another key definition in CCUS legislations. There is a discrepancy between the definitions of pore space across states over the origins of pore space.

Table 5 Pore Space Definitions

State	Definition
West Virginia H.B.4491 §(22-11B-2) (9)	“A cavity or void, whether natural or artificially created, in a subsurface sedimentary stratum and is also known as container space or storage rights.”
Utah H.B. 244 40-6-2.(23)(c)	“(a) "Pore space" means subsurface porous material possessing free space, naturally or artificially created, between the mineral grains. (b) "Pore space": (i) is expressed as a percentage; and (ii) depends on the size and sorting of the subsurface material's particles as a cubic or hexagonal package. (c) "Pore space" does not include void or cavern space created by the removal of minerals in the course of solution mining or other mining operations..”
Indiana IC 14-39-2-2(i)	“Pore space” means subsurface cavities or voids that can be used as a storage space for carbon dioxide.

“Pore Space Ownership” is equally as important as pore space. The majority of the states follow the “American rule” whereby the surface owner, not the mineral owner, owns the right to the pore space. Under this rule the mineral estate includes ownership of the underground minerals, but not of the geological formation, including the pore space. Several states have enacted pore space use and ownership statutes, including Montana, North Dakota, Oklahoma, and Wyoming. These states have all defined pore space as private property owned by the surface owner.

Only three of 11 states explicitly defined pore space ownership beyond “pore space owners.” In Utah’s definition, the scope of pore space is naturally occurring geologic formations, so the cavities created by mineral extraction are a separate entity and are under the jurisdiction of the mineral rights owner. Like most states, Utah also specified “title to pore space underlying the surface estate is vested in the owner of the surface estate.”

Contradicting Utah’s legislation definitions, the Supreme Court of North Dakota determined the use of the term “land” in the state’s Damage and Disruption Code (§ 38-11.1-04) authorized surface owners to recover compensation for a mineral developer’s use of the surface owners’ pore space for the disposal of saltwater generated as a result of drilling operations.

Alaska is unique in that the Alaska Statehood Act vested the state with public ownership of the mineral estate and limited divestiture of that ownership. In effect, the Alaska Statehood Act prohibits private ownership of mineral rights on lands granted to the State from the Federal government. As well, the Supreme Court of Alaska in the case of *City of Kenai v. Cook Inlet Natural Gas Storage Alaska, LLC*. concluded that “the State reserved to itself the mineral estate, which includes the underground storage rights” of the pore space created from mineral extraction.



If the state assumes primacy for Class VI UIC well program, any state regulations regarding pore space use would also apply to federal lands in lieu of EPA regulations.

5 Authority Establishment

Statutory authority must be granted to a state agency for development and implementation of a CCUS program.

5.1 Duties of Authority

This can also be referred to as Jurisdiction, defining which state agency is vested authority to regulate CCUS. State commissions overseeing the oil and gas industry typically also serve as the regulatory authority over CCUS. Oil and gas commissions approve other surface-related facilities and equipment. For example, the Texas Railroad Commission regulates the oil and gas industry, pipeline transporters, and surface mining operations. North Dakota’s Industrial Commission approves all oil and gas development, provides research grants, and assists in financing public infrastructure.

Table 6 Duties of Authority

State	Duties of Authority
Alabama 2022 AL S 36 §9-17-151.	"(2) The underground storage of carbon oxides, ammonia, hydrogen, nitrogen, and noble gases is in the public interest and welfare of this state and is for a public purpose.
North Dakota S.B. 2095 38-22-03 1-7	"1. Over all persons and property necessary to administer and enforce this chapter and its objectives. 2. To regulate activities relating to a storage facility, including construction, operation, and closure. 3. To enter, at a reasonable time and manner, a storage facility to inspect equipment and facilities; to observe, monitor, and investigate operations; and to inspect records required to be maintained at the facility. 4. To require that storage operators provide assurance, including bonds, that money is available to fulfill the storage operator’s duties. 5. To exercise continuing jurisdiction over storage operators and storage facilities, including the authority, after notice and hearing, to amend provisions in a permit and to revoke a permit. 6. To dissolve or change the boundaries of any Commission-established oil or gas field or unit that is within or near a storage reservoir’s boundaries. 7. To grant, for good cause, exceptions to this chapter’s requirements and implementing rules."



State	Duties of Authority
Texas S.B. 1387 Section 2. Chapter 27. Subchapter C- 1. Sec. 27.041.	<p>“(A) Except as provided by subsection (B), the Railroad Commission has Jurisdiction over the geologic storage of carbon dioxide in, and the injection of carbon dioxide into, a reservoir that is initially or may be productive of oil, gas, or geothermal resources or a saline formation directly above or below that reservoir.</p> <p>(B) The jurisdiction of the Railroad Commission over the geologic storage of carbon dioxide in, and the injection of carbon dioxide into, a saline formation described by subsection (A) is subject to the review of the Legislature based on the recommendations made in the preliminary report...Except as provided by subsection (B) , the Railroad Commission has Jurisdiction over a well used for the purpose provided by subsection (A) regardless of whether the well was initially completed for that purpose or was initially completed for another purpose and is converted to the purpose provided by subsection (A). Oklahoma appointed both the Corporation Commission and Department of Environmental Quality for CCUS legislation. A Memorandum of Understanding addressed areas in which implementation of the act would require interagency cooperation or interaction between the two agencies overseeing CCUS.”</p>

5.2 Cooperative Agreements and Contracts

The state’s designated Authority is authorized to enter into legally binding agreements with other government agencies and private entities to facilitate CCUS legislations.

Table 7 Cooperative Agreements & Contracts

State	Cooperative Agreements and Contracts
West Virginia H.B. 2860 22-11A-9.	<p>“The secretary is authorized to enter into cooperative agreements with other governments or government entities for the purpose of regulating carbon dioxide storage projects that extend beyond State regulatory authority under this article.”</p>
North Dakota S.B. 2095 38-22-20 1.-2.	<p>“The Commission may enter into agreements with other governments, government entities, and State agencies for the purpose of carrying out this chapter’s objectives. The Commission may enter into contracts with private persons to assist it in carrying out this chapter’s objectives. Unless the circumstances require otherwise, the Commission shall, in entering such contracts, follow the process set out in section 38-08-04.4. If an emergency exists the Commission may enter contracts without public notice and without competitive bidding.”</p>

5.3 Public Participation

Support from the public and other industry is critical to the long-term viability of CCUS. Engagement events, open houses, and hearings are ways for the public to be involved in the CCUS process. Since citizens may not possess a lot of information about carbon sequestration, these events can educate them about what is happening in their community.

According to the CCUS State Workgroup Public Outreach, hosted by the American Petroleum Institute, the public are concerned about safety, possible impacts to fish, land use conversion, and unknown long-term risk. In Alaska, public concerns may also include tectonic stability, increased use of transportation infrastructure, and noise.



Table 8 Public Participation

State	Public Participation
Utah H.B. 244 40-11-19.	“The governing body of a controlling State interest or interest of a political subdivision is authorized to consent to and participate in a geologic carbon storage project.”
North Dakota S.B. 2095 38-22-22	“Participation of public interests. The entity or official controlling State interests or the interests of political subdivisions is authorized to consent to and participate in a geologic storage project.”

6 Fiscal Support

Alaska Oil & Gas Conservation Commission (“AOGCC”) currently receives agency funding from fees on current oil and gas production. Implementing a Class VI permitting program under the current revenue model would result in several to many years wait between permitting a well and receipt of operational storage fees from the well. Some variety of bridge funding, such as federal grants, for the program may be needed to sustain the program until CCUS projects are operational. Bridge funding is a form of temporary, intermediate funding intended to cover AOGCC’s short-term permitting expenses until long-term funding (i.e., royalties and taxes) is received.

6.1 Fees

States impose fees to cover the costs of permitting, monitoring, and inspecting CCUS injection wells, enforcing CCUS legislations, and conducting hearings. Fees are generally required at every stage of the CCUS injection well process (application, permitting, operation, and closure). No specific fee amounts are called out in any state legislation. Fees are typically split between two funds: administrative funds and long-term storage trust funds. Administrative fund fees generally cover processing permit applications and regulating storage facilities during construction, operation, and pre-closure phases. Long-term storage trust funds hold money for activities in the post-closure phase as described in Section 3.7.5. Many states also have a stipulation to reduce fees once a storage trust fund reaches or exceeds a certain amount. For example, Mississippi’s Carbon Dioxide Storage Fund must reach or exceed \$2,500,000 per geologic sequestration facility for fees to be reduced.

Table 9 Fees

State	Fees
West Virginia H.B. 2860 22-11A-5 (b)	“Upon filing an application, an applicant shall pay a reasonable fee, as established by the secretary in legislative rules, to the department for the costs of reviewing, evaluating and processing the permit, serving notice of an application and holding any hearings. The fee shall be credited to a separate account and shall be used by the department as required to complete the tasks necessary to process, publish and reach a decision on the permit application.”



State	Fees
Texas S.B. 1387 Sec. 27.044	“The Railroad Commission may impose fees to cover the cost of permitting, monitoring, and inspecting anthropogenic carbon dioxide injection wells for geologic storage and geologic storage facilities; and enforcing and implementing this subchapter and rules adopted by the Railroad Commission under this subchapter. Fees collected by the Railroad Commission under this section shall be deposited to the credit of the Anthropogenic Carbon Dioxide Storage Trust.”
North Dakota S.B. 2095 38-22-14 1.	“Storage operators shall pay the Commission a fee on each ton of carbon dioxide injected for storage. The fee must be in the amount set by Commission rule. The amount must be based on the Commission’s anticipated expenses that it will incur in regulating storage facilities during their construction, operational, and pre-closure phases.”

6.2 Financial Responsibility and Assurance

A storage operator needs to prove they can pay all required fees, operate the CCUS project, and support the state in monitoring the site after the cessation of injections. Financial assurance is essential for short-term fiscal support needs and long-term fiscal support. Short-term fiscal support needs refer to the cost of permitting, constructing, and operating CCUS projects. Long-term fiscal support needs refer to a long-term storage trust fund. Long-term trust funds are meant to hold money for activities in the post-closure phase and are described in more detail in Section 9.5.

To demonstrate financial assurance for short-term needs, a storage operator can fund administrative funds, bonds, credit lines, insurance, and/or self-insurance.

6.3 Tax Incentives

CCUS projects are not traditional income producers and are expensive to construct and operate, so tax credits and/or incentives are the revenue and thus, essential to help grow the industry. Other states with CCUS legislation have adopted property tax exemptions to help incentivize CCUS projects within the state. Tax incentives like property tax exemptions could reduce the significant start-up costs for CCUS projects.

North Dakota’s legislation exempts carbon dioxide pipelines from property tax during construction and first 10 years of operation. The state will also reimburse local government for foregone property tax revenue from the carbon dioxide pipeline exemption. Montana’s legislation allows for 50% of the assessed value of certain “clean energy” projects up to first \$1 million in value to be exempted from property tax. The simplest tax incentive is Kansas, which exempted all CCUS property from property tax entirely.



Table 10 Tax Incentives

State	Tax Incentive
Kansas §79-233(a)	“Property exempt from taxation; carbon dioxide capture, sequestration or utilization property. (a) The following described property, to the extent herein specified, shall be exempt from all property taxes levied under the laws of the state of Kansas: Any carbon dioxide capture, sequestration or utilization property; and any electric generation unit which captures and sequesters all carbon dioxide and other emissions.”
Montana §15-24-3111	“(1) A facility listed in subsection (3), clean advanced coal research and development equipment, and renewable energy research and development equipment may qualify for an abatement of property tax liability pursuant to this part. (2)(a) If the abatement is granted for a facility listed in subsection (3), the qualifying facility must be assessed at 50% of its taxable value for the qualifying period. (b) If the abatement is granted for clean advanced coal research and development equipment or renewable energy research and development equipment, the qualifying equipment, up to the first \$1 million of the value of equipment at a facility, must be assessed at 50% of its taxable value for the qualifying period. There is no abatement for any portion of the value of equipment at a facility in excess of \$1 million.”
North Dakota § 57-06-17.1	“Property, not including land, is exempt from taxation during construction and for the first ten full taxable years following initial operation if it consists of a pipeline, constructed after 1996, and necessary associated equipment for the transportation or storage of carbon dioxide for secure geologic storage or use in enhanced recovery of oil or natural gas.”

6.4 Federal 45Q and Other Tax Credits and Incentives

The federal 45Q tax credit is a performance-based tax credit designed to incentivize CCUS projects through a tax liability offset per every captured metric ton of carbon dioxide that is geologically sequestered. The original Section 45Q tax credit was enacted by the Energy Improvement and Extension Act of 2008. The Inflation Reduction Act of 2022 raised the 45Q tax credit from \$50 per metric ton to \$85 per metric ton. The Act also gives CCUS operators a “Direct Pay Election” for five years, allowing them to claim 45Q credits as cash refunds instead of as offsets against other taxes. The Inflation Reduction Act also allows taxpayers to sell 45Q tax credits tax-free by transferring the 45Q tax credits to other taxpayers in exchange for cash. As stated before, tax credits (and now cash refunds) are the desired revenue for a CCUS project and are essential for the market.

In addition to the 45Q credit, several states offer tax credits or incentives for CCUS projects. These vary widely in scope and scale, ranging from credits, exemption or reduction of property tax, severance tax, gross receipt tax, and sales tax. Texas has the greatest variety of carbon sequestration incentives, including sales tax exemptions, franchise tax credits, and severance tax reductions, mostly associated with EOR.

California and Oregon grant credits to fuel suppliers that have reduced their carbon footprint through CCUS activities.



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Table 11 State Tax Credits and Incentives

State	Tax Incentives	Non-tax Incentives
California	EOR Credit	The Low Carbon Fuel Standard (with CCS protocol) provides suppliers of low-carbon fuels with credits that can be sold to suppliers of higher-carbon fuels. California's economy-wide cap-and-trade program covers 80 percent of the state's economy. Operators of low carbon power resources, such as power facilities with CCUS, can mostly avoid carbon allowance costs, providing a competitive advantage in the California electricity market.
Illinois	N/A	Illinois utilities are required to source electricity from "clean coal facilities" as part of the goal for at least 25 percent of electricity in Illinois to come from coal plants that capture and sequester CO ₂ emissions by 2025.
Kansas	Accelerated Depreciation Property Tax Exemption Carbon Farming Tax Credit	N/A
Kentucky	Sales and Use Tax Exemption Severance Tax Credit Credit on Corporate Income Taxes Credit on Personal Income Taxes	N/A
Louisiana	Sales and Use Tax Exemption Severance Tax Reduction	N/A
Michigan	Severance Tax Reduction	Integrated Renewable Portfolio Standard includes, to a limited extent, carbon capture and sequestration technology installed on a coal plant towards the renewable target.
Mississippi	Ad Valorem Tax Exemption Severance Tax Reduction Gross Income Tax Reduction	N/A
Montana	Reduced Property Tax	New electric generation capacity fueled by coal constructed after January 1, 2007, is required to capture and sequester at least 50 percent of CO ₂ emissions.
New Mexico	Alternative Energy Product Manufacturers Tax Credit Act	Public utilities may recover costs related to clean energy projects.
North Dakota	Sales and Use Tax Exemption Property Taxes Exemption Gross Receipts Tax Reduction	Includes CO ₂ pipelines as common carriers.
Oklahoma	Gross Production Tax Exemption	N/A
Oregon	N/A	Clean Fuels Program
Pennsylvania	N/A	The use of non-sulfur diesel fuel derived from coal is permitted as long as the fuel's carbon emissions are offset through geologic carbon sequestration or by participation in a carbon offset program.
Texas	Franchise Tax Credit Severance Tax Reductions Sales and Use Tax Exemption Gross Receipts Tax Exemption and Other Tax Incentives	Includes CO ₂ pipelines as common carriers if certain conditions are met.
Wyoming	Sales Tax Exemption Severance Tax Credit	N/A

Note: Adapted from Conners et al. (2020)



7 Permitting Process

The permitting process may involve separate permits for carbon dioxide sequestration, such as transportation. Each state lists what conditions an applicant shall follow to receive a CCUS permit. Permit conditions usually include complying with application requirements, paying a fee for the cost of processing the application, and paying a cost that assists in public notice and participation.

7.1 Pre-Application

States without primacy do not have pre-application steps or requirements, such as a pre-application meeting, prior to submitting a Class VI application with the EPA. One state with primacy, Wyoming, has requirements prior to submitting a Class VI application. The state has clear steps for screening a site, determining feasibility, and multiple pre-application meetings (**Figure 2**).



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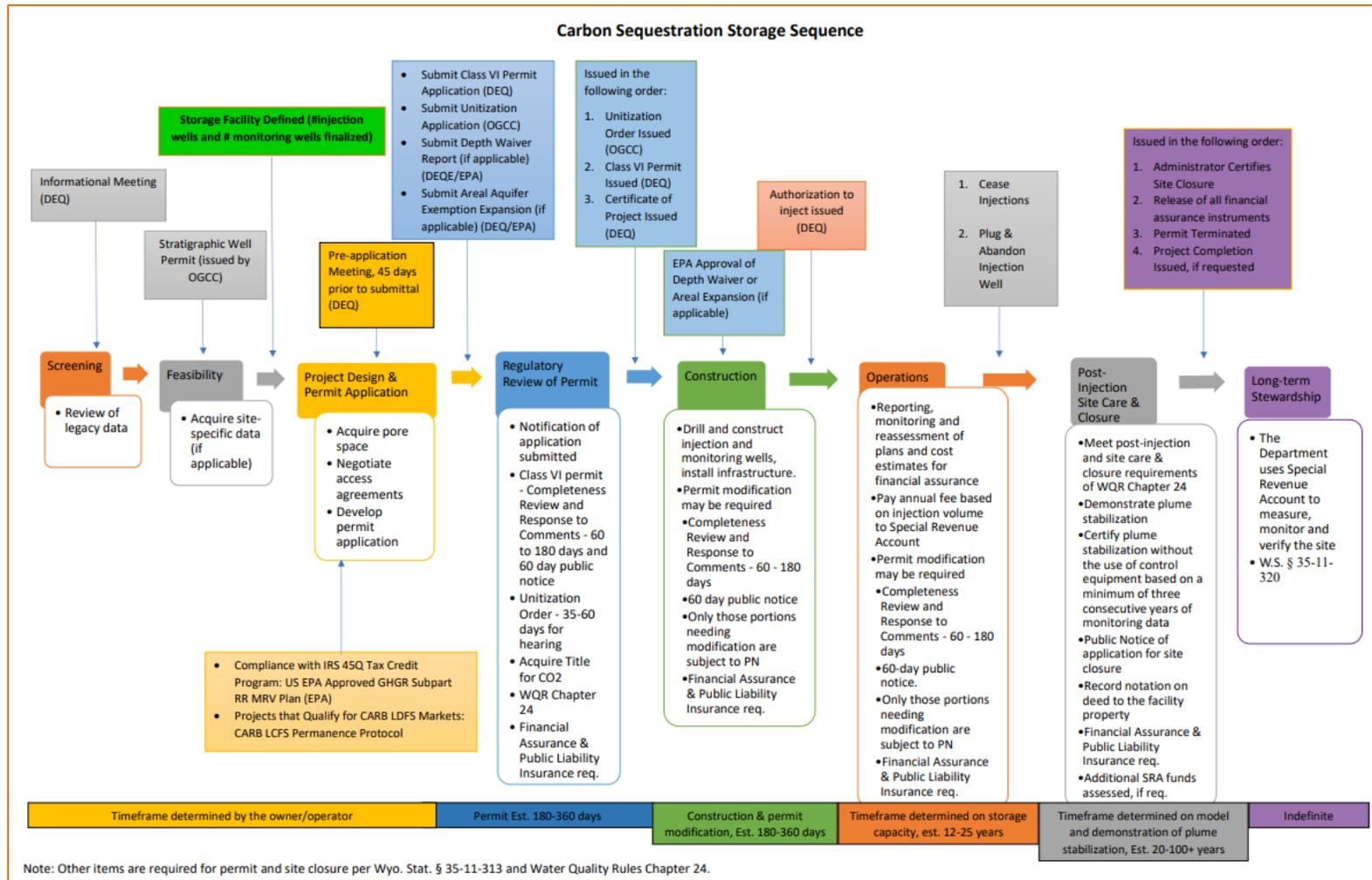


Figure 2 Carbon Sequestration Storage Sequence

(Wyoming Department of Environmental Quality, n.d.)



7.2 Permit Hearings

Hearings are held to hear evidence and accept public comment concerning an active permit application with potential environmental impacts. Hearings also inform all stakeholders (mineral rights owners, pore space owners, surface owners) of project updates. Some states give exact timelines of the hearing process while others leave it up to the designated authority.

Table 12 Public Participation

State	Permit Hearings
<p>North Dakota S.B. 2095 38-22-06</p>	<p>“1. The Commission shall hold a public hearing before issuing a permit. 2. Notice of the hearing must be published for two consecutive weeks in the official newspaper of the county or counties where the storage reservoir is proposed to be located and in any other newspaper the Commission requires. Publication deadlines must comply with Commission requirements. 3. Notice of the hearing must be given to each mineral lessee, mineral owner, and pore space owner within the storage reservoir and within one-half mile of the storage reservoir’s boundaries. 4. Notice of the hearing must be given to each surface owner of land overlying the storage reservoir and within one-half mile of the reservoir’s boundaries. 5. Notice of the hearing must be given to any additional persons that the Commission requires. 6. Service of hearing notices required by this section must conform to personal service provisions in rule 4 of the North Dakota rules of civil procedure. 7. Hearing notices required by this section must comply with deadlines set by the Commission. 8. Hearing notices required by this section must contain the information the Commission requires.”</p>
<p>Utah H.B. 244 40-11-7. (1)-(4)</p>	<p>“(1) The board shall hold a public hearing before authorizing the division to issue a permit. (2) The board shall conduct the hearing in accordance with Title 63G, Chapter 4, 474 Administrative Procedures Act. (3) The board shall give notice no fewer than 30 days prior to the hearing by: (a) one publication in a daily newspaper of general circulation in Salt Lake City, Utah; (b) in all newspapers of general circulation published in the county or counties in 478 which the land affected is situated; and(c) by publication in accordance with Section 45-1-101. (4) In addition to the notice required in Subsection (3), an applicant shall provide notice of the hearing and a copy of the permit application, no fewer than 30 days before the hearing to (a) each mineral lessee within one-half mile of the storage reservoir’s boundaries; (b) each mineral owner within one-half mile of the storage reservoir’s boundaries; (c) each pore space owner within one-half mile of the storage reservoir’s boundaries; (d) each surface owner of land within one-half mile of the storage reservoir’s boundaries.”</p>

7.3 Permit Consultation

The permitting authority may want to consult with other departments before issuing a permit. These may include the state’s department of public health or environment. In Alaska permit consultation and coordination would be required between several agencies, including the Department of Natural Resources, Alaska Oil and Gas Conservation Commission, Department of Environmental Conservation, and potentially others.



Table 13 Permit Consultation

State	Permit Consultation
Wyoming H.B. 90. 35-11-313 (f)	The administrator of the water quality division of the department of environmental quality, after receiving public comment and after consultation with the State geologist, the Wyoming oil and gas conservation Commission and the advisory board created under this act, shall recommend to the director rules, legislations and standards.”

7.4 Permit Requirements

Permit requirements necessitate an applicant to demonstrate a thorough review of the CCUS project site and its potential impacts on ground water, human health, and the environment. UIC programs are authorized through the Safe Drinking Water Act 42 U.S.C. 300f *et seq.* UIC programs are also exempt from the National Environmental Policy Act (“NEPA”) environmental assessment under Section 511(c) of the Clean Water Act because the UIC program itself requires sufficient environmental assessment. Although CCUS permits do not need to go through the NEPA permitting process, the project must still comply with all applicable federal and state environmental laws and follow the UIC and state permit requirements.



Table 14 Permit Requirements

State	Permit Requirements
<p>North Dakota S.B. 2095 38-22-08</p>	<p>“1. That the storage operator has complied with all requirements set by the Commission. 2. That the storage facility is suitable and feasible for carbon dioxide injection and storage. 3. That the carbon dioxide to be stored is of a quality that allows it to be safely and efficiently stored in the storage reservoir. 4. That the storage operator has made a good-faith effort to get the consent of all persons who own the storage reservoir’s pore space. 5. That the storage operator has obtained the consent of persons who own at least sixty percent of the storage reservoir’s pore space. 6. Whether the storage facility contains commercially valuable minerals and, if it does, a permit may be issued only if the Commission is satisfied that the interests of the mineral owners or mineral lessees will not be adversely affected or have been addressed in an arrangement entered into by the mineral owners or mineral lessees and the storage operator. 7. That the proposed storage facility will not adversely affect surface waters or formations containing fresh water. 8. That carbon dioxide will not escape from the storage reservoir. 9. That substances that compromise the objectives of this chapter or the integrity of a storage reservoir will not enter a storage reservoir. 10. That the storage facility will not endanger human health nor unduly endanger the environment. 11. That the storage facility is in the public interest. 12. That the horizontal and vertical boundaries of the storage reservoir are defined. These boundaries must include buffer areas to ensure that the storage facility is operated safely and as contemplated. 13. That the storage operator will establish monitoring facilities and protocols to assess the location and migration of carbon dioxide injected for storage and to ensure compliance with all permit, statutory, and administrative requirements. 14. That all nonconsenting pore space owners are or will be equitably compensated.”</p>

Nebraska follows similar requirements, but also calls for a geologic study that includes seismic assessment. The state also specifies how carbon dioxide will not escape from the reservoir through the atmosphere nor water.

“In accordance with the United States Environmental Protection Agency Underground Injection Control program, that the storage operator has completed a comprehensive geologic study which includes a seismic risk assessment.”

Utah also follows similar requirements, but also requires plans for ensuring compliance, requires 70% of pore space owners to consent to CCUS, and explicitly limits carbon dioxide escapement.

“Carbon dioxide will not escape from the storage reservoir at a rate exceeding the lower of 1% or the standard recommended by the Environmental Protection Agency.”



7.5 Permit Provisions

Permit provisions refer to extra requirements or conditions in the state CCUS legislation. West Virginia added a provision about agents and Mississippi included many provisions regarding oil and gas production in connection with a CCUS project.

Table 15 Permit Provisions

State	Permit Provisions
West Virginia H.B. 4491 §22-11B-6 (a)-(b)	“The secretary may include in any permit or order all things necessary to carry out this article’s objectives and to protect and adjust the respective rights and obligations of persons affected by a carbon dioxide sequestration facility. Every well operator required to designate an agent under this article shall, within five days after the termination of the designation, notify the secretary of the termination and designate a new agent.”
Mississippi S.B. 2723 53-11-15 (1)(c)(i)	<p>“A provision for:</p> <ul style="list-style-type: none"> (i) access to and use of a reasonable amount of the surface area within the unit area by the storage operator and his agents in connection with constructing, equipping, operating, maintaining and terminating operations of the geologic sequestration facility; and (ii) payment of the reasonable costs of compensable damages to the surface and reasonable consideration for use of the surface area.”

7.6 Amalgamating Property Interests

Amalgamating property interests means combining many properties from one single large property, usually facilitated by multiple property owners.

Amalgamating property can also be facilitated by a state government, like eminent domain. While eminent domain refers to the right of a government to expropriate private property to public use in return for payment of compensation, amalgamating property interests refers to the government’s right to order the pooling of the desired pore space licensing for a CCUS project in return for payment of compensation. The pore space owners still own their pore space, but the state may allow the pore space to be licensed to the project, with compensation, regardless of if all the pore space owner consented to the licensing.

Naturally, some owners may want to license pore space to a CCUS project while others may not. Since subsurface property is harder to delineate than surface property lines, a nonconsenting owner’s pore space may not be separable from the desired pore space reservoir. Therefore, amalgamating can be necessary.

Before ordering an amalgamation of property, the state needs to see the applicant/storage operator make “good faith” attempts to acquire the license to use the desired pore space. A “good faith” attempt refers to a diligent and honest effort to contact the pore space owners to secure licensing.

In addition to good faith efforts, an applicant/storage operator needs to secure a certain percentage of the interest in pore space. The minimum percentage of the interest in pore space (licensing) required varies



among states. At the very least, an applicant/storage operator needs a majority approval, 51%. Some states, such as Utah, set the minimum percent required at 70%.

States vary in how they amalgamate properties of consenting and nonconsenting owners for a CCUS permit.

Table 16 Amalgamation of Property Interests

State	Amalgamation of Property Interests
Utah H.B. 244 40-11-11. (1) & 40-11-6.(3)(c)	“The board may hold a hearing to consider the need for the amalgamation of a tract of land for geologic carbon storage.: (c) that owners who own no less than 70% of the reservoir’s pore space have provided written consent to the use of the owners’ pore space for a storage facility;
North Dakota S.B. 2095 38-22-10	“If a storage operator does not obtain the consent of all persons who own the storage reservoir’s pore space, the Commission may require that the pore space owned by nonconsenting owners be included in a storage facility and subject to geologic storage. When the Commission issues a permit it shall also issue a certificate stating that the permit has been issued, describing the area covered, and containing other information the Commission deems appropriate. The Commission shall file a copy of the certificate with the county recorder in the county or counties where the storage facility is located.”

8 Resource Designation

Title to resources should be addressed early in the CCUS legislation to assist in creating a regulatory scope. Resources to identify ownership and title includes pore space, carbon throughout the CCUS process, minerals, and property. The rights of owners are also addressed in other state CCUS legislation.

8.1 Pore Space Licensing

Pore space ownership is not a clear and settled area of property rights law in all states. However, most states are leaning towards the American rule, designating ownership of pore space (any geological formations below the surface) to the surface estate owners. These owners have the choice to license their pore space for a CCUS project.

The federal government is also leaning towards the American rule, but the federal government has not explicitly defined pore space ownership. The United States Supreme Court has not ruled on pore space ownership, nor has the Legislative branch enacted any laws. However, the Bureau of Land Management recently issued an Instruction Memorandum (No. 2022-041) as the national policy for right-of-way authorizations for carbon sequestration projects. The Memorandum stated the following regarding pore space ownership:

“Typically, pore space is owned by the surface owner, although it may be separately conveyed. In determining pore-space ownership, title documents should be reviewed. Questions about pore-space ownership should be resolved in coordination with the Solicitor’s Office.”



Governments outside of the United States typically follow the “English rule” and designate pore space ownership to the government itself. Governments of Australia, Norway, and Canada all claim ownership of all underground geologic formations (including minerals and pore space) below the surface. These countries may enter into an agreement with a person that grants them leases and/or licenses to the geologic formations. Alaska more closely follows the English rule than the American rule. In certain cases the federal government may own the surface estate while an Alaska Native Corporation has been granted the mineral rights (subsurface estate).

Table 17 Pore Space Licensing

State	Pore Space Licensing
Wyoming H.B. 89 34-1-152 (b)	“The ownership of pore space in strata may be conveyed in the manner provided by law for the transfer of mineral interests in real property. No agreement conveying mineral or other interests underlying the surface shall act to convey ownership of any pore space in the stratum unless the agreement explicitly conveys that ownership interest.”
Alberta, Canada Mines and Minerals Act RSA 2000, c M-17 15.1(1)	<p>“(a) no grant from the Crown of any land in Alberta, or mines or minerals in any land in Alberta, has operated or will operate as a conveyance of the title to the pore space contained in, occupied by or formerly occupied by minerals or water below the surface of that land,</p> <p>(b) the pore space below the surface of all land in Alberta is vested in and is the property of the Crown in right of Alberta and remains the property of the Crown in right of Alberta whether or not</p> <p style="padding-left: 40px;">(i) this Act, or an agreement issued under this Act, grants rights in respect of the subsurface reservoir or in respect of minerals occupying the subsurface reservoir, or</p> <p style="padding-left: 40px;">(ii) minerals or water is produced, recovered or extracted from the subsurface reservoir, and...</p> <p>(3) The Minister may enter into agreements with respect to the use of pore space.”</p>
Country of Norway Legislation for carbon dioxide Section 1-2.	“The Norwegian State has the proprietary right to subsea reservoirs on the continental shelf for exploitation of said reservoirs for storage of CO ₂ and has an exclusive right to management of said reservoirs.”
Victoria, Australia Greenhouse Gas Geological Sequestration Act Part 2 14(1)-(4)	<p>“(1) The Crown owns all underground geological storage formations below the surface of any land in Victoria.</p> <p>(2) Subsection (1) does not apply in relation to any land (other than Crown land) to the extent that the underground geological storage formation is within 15.24 metres of the surface of the land.</p> <p>(3) Subsection (1) applies despite any prior alienation of Crown land.</p> <p>(4) The Crown is not liable to pay any compensation in respect of a loss caused by the operation of this section.”</p>

8.2 Mineral Ownership

Mineral rights are the ownership rights to underground resources, including fossil fuels, ore, and mineable rocks. Mineral rights are separate from surface rights and can be considered a type of subsurface right, but not completely interchangeable. The ability to mine for minerals may be affected by a CCUS injection well, creating a rivalrous use between subsurface and surface right owners. Therefore, states address



how the state will maintain the rights of mineral rights owners and pore space owners to be non-exclusionary.

Table 18 Mineral Ownership

State	Mineral Ownership
Nebraska NE L650 Section 4	“(1) Title to any reservoir estate underlying the surface of lands and waters is vested in the owner of the overlying surface estate unless it has been severed and separately conveyed.”
Wyoming H.B. 89 34-1-202 (c)	“This act shall not alter the law of Wyoming regarding the primacy of the mineral estate and any easement created hereunder shall not limit the right of a mineral owner or his lessee to reasonable use of the surface for the purpose of mineral exploration and production unless the owners and lessees of the entire mineral estate....”
North Dakota S.B 2095 38-22-08 6.	“Whether the storage facility contains commercially valuable minerals and, if it does, a permit may be issued only if the Commission is satisfied that the interests of the mineral owners or mineral lessees will not be adversely affected or have been addressed in an arrangement entered into by the mineral owners or mineral lessees and the storage operator.”

8.3 Preservation of Rights

Preservation of rights means the rights acquired in the past are still considered a valid contract, even if the rights were acquired through antiquated rules. Many CCUS legislations explicitly address preserving mineral owners’ rights.

Additionally, many states require the location of the CCUS project to be a site with no valuable minerals, to protect the interests of mineral owners or lessees. The European Union (“EU”) continues this priority of mineral interests. The EU member states legislations allow the states to prioritize other uses of the underground geologic formations and are encouraged to consider other energy-related projects in the same space.

Although resource extraction is prioritized, drilling through an active carbon dioxide storage reservoir for oil and gas production at a greater depth is technically feasible, provided appropriate geologic formations and safety measures are in place.

Table 19 Preservation of Rights

State	Preservation of Rights
Indiana IC 14-39-2 Chapter 2 Section 1	(c) Except as otherwise provided in this chapter, this chapter applies to the underground storage of carbon dioxide. (d) The rights and requirements of this chapter: (1) are subordinate to the rights pertaining to oil, gas, and coal resources; and (2) may not adversely affect oil, gas, and coal resources, except as is strictly necessary to construct and maintain a carbon sequestration project that will provide for the permanent storage of carbon dioxide.
Oklahoma S.B. 610 Section 6. B.	“Nothing in this act shall alter the incidents of ownership, or other rights, of the owners of the mineral estate or adversely affect enhanced oil or gas recovery efforts in the state.”



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State	Preservation of Rights
West Virginia H.B. 2860 22-11A-8. (b)	“Nothing in this article is intended to impede or impair the ability of an oil, natural gas, or coalbed methane operator to inject carbon dioxide through an approved enhanced oil, natural gas, or coalbed methane recovery project and to establish, verify, register, and sell emission reduction credits associated with the project.”
North Dakota S.B. 2095 38-22-13	“Nothing in this chapter nor the issuing of a permit: 1. Prejudices the rights of property owners within a storage facility to exercise rights that have not been committed to a storage facility. 2. Prevents a mineral owner or mineral lessee from drilling through or near a storage reservoir to explore for and develop minerals, provided the drilling, production, and related activities comply with commission requirements that preserve the storage facility’s integrity and protect this chapter’s objectives.”
Kentucky H.B. 259 Section 3. (2)	“To be approved, a project shall inject carbon dioxide into pore space that contains no economically recoverable minerals at the time of the injection.”
Mississippi S.B. 2723 53-11-9. (1)(c)(ii)	“The reservoir has a greater value or utility as a reservoir for carbon dioxide storage than for the production of the remaining volumes of reservoir oil, gas, condensate or other commercial mineral, if any, and the requirements of Sections 53-11-11 and 53-11-13 have been satisfied. Approval of a geologic sequestration facility by the board shall provide full and complete authority for the construction, equipping and operation of the geologic sequestration facility without need of further action or grant by any person.”
European Union Directive 2009/31/EC Introduction (19)	“Member States should retain the right to determine the areas within their territory from which storage sites may be selected. This includes the right of Member States not to allow any storage in parts or on the whole of their territory, or to give priority to any other use of the underground, such as exploration, production and storage of hydrocarbons or geothermal use of aquifers. In this context, Member States should in particular give due consideration to other energy-related options for the use of a potential storage site, including options which are strategic for the security of the Member State’s energy supply or for the development of renewable sources of energy.”

9 Liability

Liability is the state of being responsible for something, especially by law. All active CCUS projects are still in the beginning stages since the CCUS industry itself is relatively new. No projects have reached the closure or post-closure phase. Post-closure risks, such as carbon dioxide plume migration, have not been fully actualized. To mitigate this limited understanding of sequestered carbon dioxide, the EPA set a minimum monitoring period of 50 years after cessation of injection. During the 50-year period, the carbon dioxide will be monitored to track if it is escaping from the storage reservoir. Although the EPA designates a 50-year monitoring period, it is not clear who is liable for the carbon dioxide itself during or after the monitoring period.

In addition to the lack of experience with sequestered carbon dioxide, a possible change in carbon dioxide ownership and transfer of liability during the post-closure phase adds more uncertainty. Other states and government agencies are preparing for the state to have a role in post-closure site management and take on long-term liability.



9.1 Pore Space Liability

In most states, pore space owners do not hold liability for the injected carbon dioxide when licensing their pore space.

Table 20 Pore Space Liability

State	Pore Space Liability
Utah H.B. 244 40-11-15 (3).	“An owner of pore space does not incur liability for geologic carbon storage activity by virtue of ownership of or of leasing out the pore space.”
Wyoming S.F. 47 34-1-15”3	(a) All carbon dioxide, and other substances injected incidental to the injection of carbon dioxide, injected into any geologic sequestration site for the purpose of geologic sequestration shall be presumed to be owned by the injector of such material subject to W.S. 35-11-318 and 35-11-319 and all rights, benefits, burdens and liabilities of such ownership shall belong to the injector. This presumption may be rebutted by a person claiming contrary ownership by a preponderance of the evidence in an action to establish ownership. (b) Except as provided in W.S. 35-11-318 and 35-11-319, no owner of pore space, other person holding any right to control pore space or other surface or subsurface interest holder, shall be liable for the effects of injecting carbon dioxide for geologic sequestration purposes, or for the effects of injecting other substances for the purpose of geologic sequestration which substances are injected incidental to the injection of carbon dioxide, solely by virtue of their interest or by their having given consent to the injection.”

9.2 Operating Liability

The storage operator has title, or actual ownership of property, of the carbon dioxide associated with the CCUS project, and thus holds all rights, responsibilities, and liability. No states hold liability for the CCUS project during the operating life of the project.

Table 21 Title and Liability

State	Title and Liability
North Dakota S.B. 2095 38-22-16	“The storage operator has title to the carbon dioxide injected into and stored in a storage reservoir and holds title until the Commission issues a certificate of project completion. While the storage operator holds title, the operator is liable for any damage the carbon dioxide may cause, including damage caused by carbon dioxide that escapes from the storage facility.”
Nebraska L.B. 650 Sec. 18	“The storage operator has title to the carbon dioxide injected into and stored in a storage reservoir and holds title until the commission issues a certificate of project completion under Section 19 of this act. While the storage operator holds title, the operator is liable for any damage the carbon dioxide may cause, including damage caused by carbon dioxide that escapes from the storage facility.”
Wyoming S.F. 47 35-11-318. (b)	“An injector shall: have title to any carbon dioxide the injector injects into and stores underground or within a unit area; hold title for any injected or stored carbon dioxide until the department issues a certificate of project completion. During any time, the injector holds title to carbon dioxide under this section, the injector shall be liable for any damage the injected or stored carbon dioxide may cause, including damage caused by carbon dioxide that escapes or is released from where it is being stored underground.”



State	Title and Liability
Kansas H.B. 2418 55-1637 (H)	“(H) No rule or regulation adopted under the provisions of this section shall create or impose upon the Commission, any agent or employee thereof or the state of Kansas any liability for the underground storage of carbon dioxide or the maintenance of any carbon dioxide injection well or underground storage of carbon dioxide except as permitted by the Kansas tort claims act. From and after July 1, 2010, any requirement in any rule and regulation adopted by the Commission which conflicts with the prohibition prescribed in this section shall be null and void.”
Utah	“(1) The storage operator has title to the carbon dioxide injected into and stored in a storage reservoir and holds title until the board issues a certificate of project completion. “(2) The storage operator is liable for any damage the stored carbon dioxide may cause, including damage caused by escaping stored carbon dioxide until the board issues a certificate of completion.”

Operational liabilities can be incurred by violation of CCUS statutes or by violations of common law (i.e., negligent operation, trespass, nuisance, or injury to neighboring property owners). The risks associated with operational liabilities is usually addressed through financial assurance requirements (in Section 3.4.1). Alaska has well established financial assurance requirements for the oil and gas industry that can be utilized as models for CCUS projects.

9.3 Long-term Liability

Long-term liability refers to Phase V, from the figure below. The storage operator has liability of carbon dioxide from Phase II to Phase IV, highlighted in yellow.

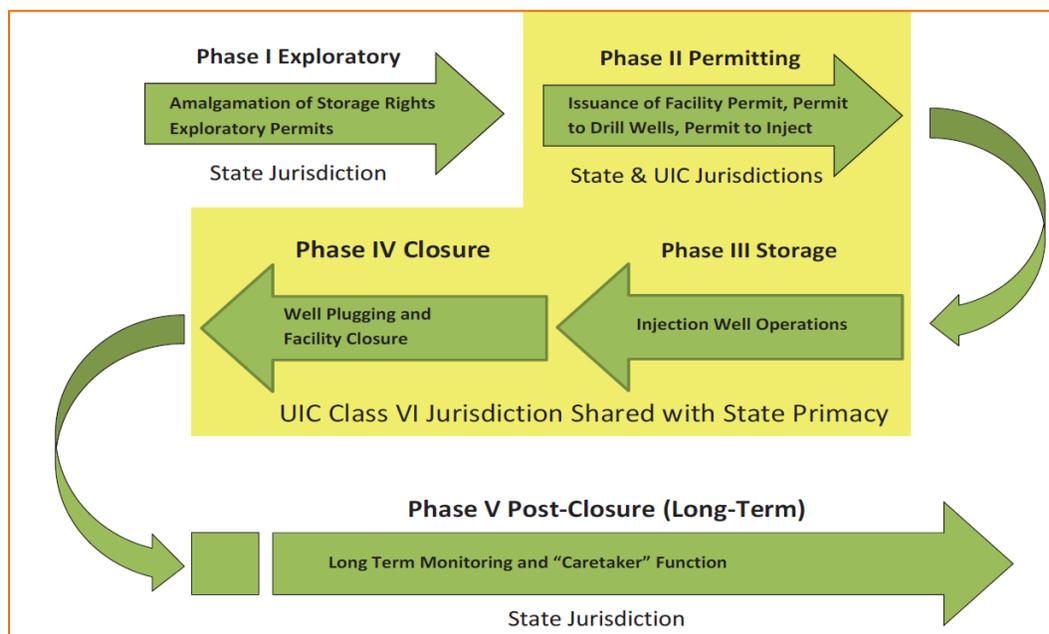


Figure 3 CCUS Project Flow Diagram

(IOGCC 2014)



Peer-State Carbon Capture, Utilization, and Sequestration Regulatory Regimes

Liability

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Liability is not guaranteed to be transferred after a project is completed. A state can take on different degrees of long-term liability for Phase V, Post-Closure:

- **Full Liability:** State becomes solely responsible for carbon dioxide in storage reservoir and CCUS project, the storage operator is released from all liability.
 - North Dakota, West Virginia, Wyoming, Alberta, Utah
- **Partial Liability:** State is partially responsible for carbon dioxide in storage reservoir and CCUS project, the storage operator shares liability.
 - Texas, Mississippi, Louisiana
- **No Liability:** State is not responsible for carbon dioxide in storage reservoir and CCUS project, the storage operator has full liability.
 - Federal (BLM)

There is a general trend of the state assuming full liability after the Certificate of Project Completion is issued. States identified with assuming partial liability made caveats for the storage operator being liable for carbon dioxide operations prior to injection, any omission of information, and restoration of facilities. In Louisiana, transfer of ownership does not assume transfer of liability; the state can take ownership but not liability if a CCUS project cannot show mechanical integrity. In all jurisdictions reviewed apart from West Virginia, the title of the storage facility and stored carbon dioxide is transferred to the state. West Virginia transfers the title of the stored carbon dioxide back to the pore space owners, but the liability of that stored carbon dioxide is transferred to the state.

Table 22 Long-Term Liability

State	Long-Term Liability
North Dakota SB 2095 38-22-17.6.	"Once a certificate is issued: A. Title to the storage facility and to the stored carbon dioxide transfers, without payment of any compensation, to the state. B. Title acquired by the state includes all rights and interests in, and all responsibilities associated with, the stored carbon dioxide. C. The storage operator and all persons who generated any injected carbon dioxide are released from all regulatory requirements associated with the storage facility. D. Any bonds posted by the storage operator must be released. E. Monitoring and managing the storage facility is the state's responsibility to be overseen by the commission until such time as the federal government assumes responsibility for the long-term monitoring and management of storage facilities."
Texas EC. 382.507. (a)- (b)	"(a) The board shall acquire title to carbon dioxide stored in the carbon dioxide repository on a determination by the board that permanent storage has been verified and that the storage location has met all applicable state and federal requirements for closure of carbon dioxide storage sites. (b) The right, title, and interest in carbon dioxide acquired under this section are the property of the permanent school fund and shall be administered and controlled by the board."



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State	Long-Term Liability
Texas ec. 382.508. (a)- (b)	<p>“(a) The transfer of title to the state under section 382.507 does not relieve a producer of carbon dioxide of liability for any act or omission regarding the generation of stored carbon dioxide performed before the carbon dioxide was stored.</p> <p>(b) On the date the permanent school fund, under section 382.507, acquires the right, title, and interest in carbon dioxide, the producer of the carbon dioxide is relieved of liability for any act or omission regarding the carbon dioxide in the carbon dioxide repository.</p> <p>(c) this section does not relieve a person who contracts with the board under section 382.504(b) of liability for any act or omission regarding the construction or operation, as applicable, of the carbon dioxide repository.”</p>
West Virginia H.B 4491 §22-11B-12. (c) (1)-(3)	<p>“(c) As of the effective date of a completion certificate:</p> <p>(1) Ownership of the stored carbon dioxide transfers, without payment of any compensation, to the owners of the pore space as established in §22-11B-18 of this code;</p> <p>(2) Ownership acquired by the pore space owners under subdivision (c)(1) of this section includes all rights and interests in the stored carbon dioxide and any associated leasing rights; <u>Provided, That all liability and regulatory requirements associated with the stored carbon dioxide shall become the responsibility of the state and the state shall defend, indemnify, and hold harmless the pore space and surface owners against all claims using only funds from the Carbon Dioxide Storage Facility Trust Fund;</u></p> <p>(3) The storage operator and all persons who transported and/or generated any stored carbon dioxide are released from all liability and regulatory requirements associated with the storage facility;”</p>
Wyoming S.F. 47 35-11-319 (d) (iv)- (vi)	<p>“(iv) The injector and all persons who generated any injected or stored carbon dioxide shall be forever released from all regulatory requirements associated with the continued storage and maintenance of the injected carbon dioxide;</p> <p>(v) Any bond or financial assurance submitted to the department under W.S. 35-11-313 through 35-11- 317 shall be released;</p> <p>(vi) The state, through the department, shall assume responsibility to manage and monitor the stored carbon dioxide until such time when the federal government assumes responsibility for the long term monitoring and management of stored carbon dioxide.”</p>
Mississippi S.B. 2723 53-11-25 (2)	<p>“2) Nothing in this chapter shall establish or create any liability or responsibility on the part of the board or the state to pay any costs associated with facility restoration from any source other than the performance bond, deposit, other assurance of performance, or financial assurances posted or required pursuant to this chapter, nor shall the board or the state have any liability or responsibility to make any payments for costs associated with facility restoration.”</p>
Louisiana H.B. 661 Section 1109 (4)	<p>“It is the intent of this section that the state shall not assume or have any liability by the mere act of assuming ownership of a storage facility after issuance of a certificate of completion of injection operations.”</p>
Alberta, Canada Mines and Minerals Act RSA 2000, c M-17 121(1)(b)	<p>“The Minister...assumes all obligations of the lessee as owner and licensee under the Oil and Gas Conservation Act of the wells and facilities covered by that agreement,</p> <p>(ii) as the person responsible for the injected captured carbon dioxide under the Environmental Protection and Enhancement Act,</p> <p>(iii) as the operator under Part 6 of the Environmental Protection and Enhancement Act in respect of the land within the location of the agreement used by the lessee in relation to the injection of captured carbon dioxide, and</p> <p>(iv) under the Surface Rights Act,”</p>



9.4 Federal Liability

For states without primacy, the EPA requires a post-closure plan that includes monitoring for 50 years (40CFR146.93(b)(2)) before the EPA will review potential site closure. The wording of the regulation, and the prefatory text in the Federal Register (FR Vol.75, No. 237, Dec. 10, 2010) implies that the owner or operator of the CCUS facility is directly liable until site closure and may be liable for violations of federal regulations indefinitely. As noted in the Federal Register,

“EPA acknowledges stakeholder interest in liability and long-term stewardship in the context of development and deployment of GS technology, however, under current SDWA provisions EPA does not have authority to transfer liability from one entity (i.e., owner or operator) to another.”
(page 77272)

Wyoming, North Dakota, Kansas, and West Virginia’s legislations referred to the federal government assuming liability from the storage operator and/or state in the future.

Table 23 Federal Liability

State	Federal Liability
Wyoming S.F. 47 35-11-319 (d) (vi)	“(vi) The state, through the department, shall assume responsibility to manage and monitor the stored carbon dioxide until such time when the federal government assumes responsibility for the long term monitoring and management of stored carbon dioxide.”
North Dakota SB 2095 38-22-17.6. E.	“Monitoring and managing the storage facility is the state’s responsibility to be overseen by the commission until such time as the federal government assumes responsibility for the long-term monitoring and management of storage facilities.”
West Virginia H.B 4491 §22-11B-12. (c) (5)	“Notwithstanding ownership of the stored carbon dioxide in the pore space owners as provided herein, monitoring, and managing the storage facility shall become the state’s responsibility to be overseen by the secretary utilizing only money from the Carbon Dioxide Storage Facility Trust Fund until such time as the federal government assumes responsibility for the long-term monitoring and management of storage facilities.”
Kansas H.B. 259 353 Section 6. (3) – (4)	“(3) The ownership and liability for a storage facility may be transferred to: (a) The federal government if a federal program exists; or (b) The Finance and Administration Cabinet pursuant to subsections (4) to (6) of this section if a federal program does not exist. (4) If no federal program exists, and the storage operator seeks to transfer the ownership and liability of a storage facility to the Finance and Administration Cabinet, after completion of the required period of monitoring following completion and plugging, the storage operator shall notify the division of its intent to transfer ownership of the stored carbon dioxide and associated liability to the Finance and Administration Cabinet. The storage operator shall provide evidence to the division of the satisfactory completion of all permit conditions pertaining to the demonstration carbon injection well. Upon receipt and evaluation of satisfactory evidence, the division shall forward the evidence to the Finance and Administration Cabinet with a recommendation for the transfer of ownership of the stored carbon dioxide and liability. The storage operator may then apply to the Finance and Administration Cabinet for the transfer of ownership and liability for the stored carbon dioxide.”



9.5 Funding Long-term Liability

A long-term storage trust fund is meant to hold money for activities in the post-closure phase. Often, liability may only be released if there are sufficient trust funds to address or remediate any duty, obligation, or liability that may arise after a verification of completion is issued, such as long-term monitoring and management of the storage facility. Sufficient storage trust funds assure liability will not be the burden of the state and people. Many states reviewed will not release liability from the storage operators if there are insufficient funds in a long-term trust fund.

Table 24 Long-Term Liability Funding Requirements

State	Long-Term Liability Funding Requirements
Louisiana H.B. 661 Section 1109 (2)	"Provided the provisions pertaining to site-specific trust accounts are not applicable, such release from liability will not apply to the owner or last operator of record of a storage facility if the carbon dioxide geologic storage trust fund has been depleted of funds such that it contains inadequate funds to address or remediate any duty, obligation, or liability that may arise after issuance of the certificate of completion of injection operations."

States have many options to fund these long-term liability trust funds:

- Per-ton injection fees
- Lump sum closure fees
- Rent of pore space and surface land
- Royalties or portions on 45Q Tax Credits

CCUS legislations require permitting fees (as described in Section 6.1 Fees) to be deposited in designated administrative and trust funds to facilitate CCUS injection wells. CCUS legislation generally includes a per-ton injection fee during CCUS operations for funding long-term liability trust funds.

Table 25 Funding Long-Term Liability

State	Funding Long-Term Liability
North Dakota S.B. 2095 38-22-15 1	"Storage operators shall pay the Commission a fee on each ton of carbon dioxide injected for storage. The fee must be in the amount set by Commission rule. The amount must be based on the Commission's anticipated expenses associated with the long-term monitoring and management of a closed storage facility."
Nebraska L.B 650 Sec. 7. (1)	"(1) A Person applying for a permit shall: (a) comply with application requirements set by the Commission; (b) pay a fee in an amount set by the Commission. The amount of the fee shall be set by rule and legislation and shall be based on the Commission's anticipated cost of processing the application. The fee shall be deposited in the carbon dioxide storage facility administrative fund; and (c) pay to the Commission the costs the Commission incurs in publishing notices for hearings and holding hearings on permit applications."



State	Funding Long-Term Liability
Mississippi § 53-11-23. (1)(c)	“Any per-ton fee shall first be applied to the administration and enforcement costs of the board’s activities required or authorized by this chapter, and any amount exceeding those costs shall be transferred to a separate special fund of the State Oil and Gas Board which is hereby created and is to be known as the Carbon Dioxide Storage Fund.”
Indiana IC 14-39-2-9	<p>(a) A storage operator shall pay the department a fee for every ton of carbon dioxide injected for storage.</p> <p>(b) The storage operator shall provide the department with an estimate of the amount of carbon dioxide to be injected into a storage facility for the period of the permit at the time of application for a carbon sequestration project permit.</p> <p>(c) A storage operator shall pay annually to the department a fee of eight cents (\$0.08) per ton of carbon dioxide estimated to be injected into a storage facility.</p> <p>(d) A storage operator shall reconcile the previous calendar year’s payment with the volume of carbon dioxide actually injected into the storage facility the previous calendar year. The storage operator shall submit payment for the amount of carbon dioxide injected into a storage facility less the amount paid the previous calendar year.</p> <p>(e) The department shall refund a storage operator any overpayment in the current year from the previous calendar year.</p>

10 Operations

CCUS operations requirements typically include measuring, monitoring, and verification plans, verification of storage amounts, and penalties for non-compliance.

10.1 Measuring, Monitoring, and Verification Plan

CCUS projects can be strictly sequestration, or they can be used for enhanced oil recovery. For both types of projects, measurement and monitoring of carbon dioxide to confirm conformance and containment is a critical activity. Commitment to undertake measurement and monitoring and to report this data is done through a measurement, monitoring, and verification (“MMV”) plan and in many jurisdictions is a condition of project approval.

10.2 Storage Amount

Carbon dioxide injection and storage volumes are measured as part of the project’s MMV plan. This data can be applied to carbon credits, allowances, emissions allocations, and offsets, as well as for public reporting requirements.



Table 26 Storage Amount

State	Storage Amount
North Dakota S.B 2095 38-22-23	<p>“1. The Commission, under procedures and criteria it may adopt, shall determine the amount of injected carbon dioxide stored in a reservoir that has been or is being used for an enhanced oil or gas recovery project. The Commission may also make such a determination for carbon dioxide stored under this chapter.</p> <p>2. The purpose for determining storage amounts is to facilitate using the stored carbon dioxide for such matters as carbon credits, allowances, trading, emissions allocations, and offsets, and for other similar purposes.</p> <p>3. The Commission may charge a reasonable fee to the person requesting a storage determination. The fee must be set by rule.</p> <p>4. Fees the Commission receives for storage determinations must be deposited into the carbon dioxide storage facility administrative fund.”</p>

10.3 Enhanced Recovery Projects

Enhanced oil and gas recovery (“EOR”) is the process that involves the injection of fluids to retain or increase reservoir pressure and as a result, displace extractable oil and gas, the fluid is often naturally occurring or anthropogenic carbon dioxide. EOR is regulated through the EPA’s Class II Underground Injection Control Program. According to an EPA memorandum from 2015, Class II EOR injection wells have the potential to transition into Class VI injection wells because both wells inject carbon products as liquid into underground formations. The memorandum outlines the key principles for transitioning Class II wells. However, the absence of finalized technical guidance from the EPA creates a lack of clarity and consistency for state legislation. EOR injection wells are sometimes included in a CCUS program or regulated separately. Some states, such as Oklahoma, include EOR as a part of CCUS, others do not, such as North Dakota.

Table 27 Enhanced Recovery

State	Enhanced Recovery Projects
Oklahoma S.B. 610 Section 3. A.	<p>“The Commission shall have such jurisdiction regardless of whether such carbon dioxide sequestration facility or other injection of carbon dioxide involves enhanced oil or gas recovery.”</p>
North Dakota S.B. 2095 38-22-19	<p>“This chapter does not apply to applications filed with the Commission proposing to use carbon dioxide for an enhanced oil or gas recovery project, rather such applications will be processed under chapter 38-08. 2. The Commission may allow an enhanced oil or gas recovery project to be converted to a storage facility. In considering whether to approve a conversion, and upon conversion, the provisions of this chapter and its implementing rules apply, but if during the conversion process unique circumstances arise, the Commission, to better ensure that the chapter’s objectives are fulfilled, may waive such provisions and may impose additional ones.”</p>



10.4 Penalties

Penalties are also referred to as compliance and enforcement. A person or entity who violates any provisions or rules in a CCUS legislation is subject to civil penalty until the person corrects to the provision or rule. The amount of a penalty is determined by the nature of the violation, circumstances and gravity, and hazard or potential hazards to others. Economic or environmental harm, history of previous violations, efforts to correct the violation, and the amount necessary to deter future violations are also factors in the penalty amount. There is a significant discrepancy between states on the maximum civil penalty amount per day per violation. Many states leave penalties up to the discretion of the authority, and a few states have explicit caps on penalties. The table below shows a sample of maximum civil penalties, ascending in amount.

Table 28 Civil Penalty Amounts

State	Civil Penalty Amounts
Nebraska	Class II Misdemeanor (\$1,000) or 6 months imprisonment
Mississippi	\$5,000
Louisiana	\$5,000
Utah	\$10,000
Kansas	\$10,000
North Dakota	\$12,500
West Virginia	\$25,000

The language of declaring penalties communicates that the civil penalty cost is cumulative. Kansas law stipulates “every day such violation continues shall be deemed a separate violation.”

Table 29 Penalty Language

State	Language of Penalties
Kansas HB 2419 New Sec. 4. a.	“The Commission, upon a finding that a person has violated any provision of section 2, and amendments thereto, or rules and legislations adopted thereunder, may impose a penalty not to exceed \$ 10,000 per violation which shall constitute an economic deterrent to the violation for which it is assessed and, in the case of a continuing violation, every day such violation continues shall be deemed a separate violation.”
West Virginia H.B.2860 22-11-22. (a)	“Any person who violates any provision of any permit issued under or subject to the provisions of this article or article eleven-a of this chapter is subject to a civil penalty not to exceed \$ 25,000 per day of such violation and any person who violates any provision of this article or of any rule or who violates any standard or order promulgated or made and entered under the provisions of this article, article eleven-a of this chapter or article one, chapter twenty-two-b of this code is subject to a civil penalty not to exceed \$ 25,000 per day of such violation.”



10.5 Certificate of Project Completion

There are multiple phases of the project completion process, with the first step typically as termination of carbon dioxide injection. Next, the storage operator must apply for project completion by proving the reservoir can maintain integrity, often referred to as the cessation of storage operations. The application for project completion may also include hearings, public notices, and consultations with other state departments (such as a department of health). Finally, once integrity is established and the state issues a Certificate of Project Completion, the storage operator can transfer ownership to the state.

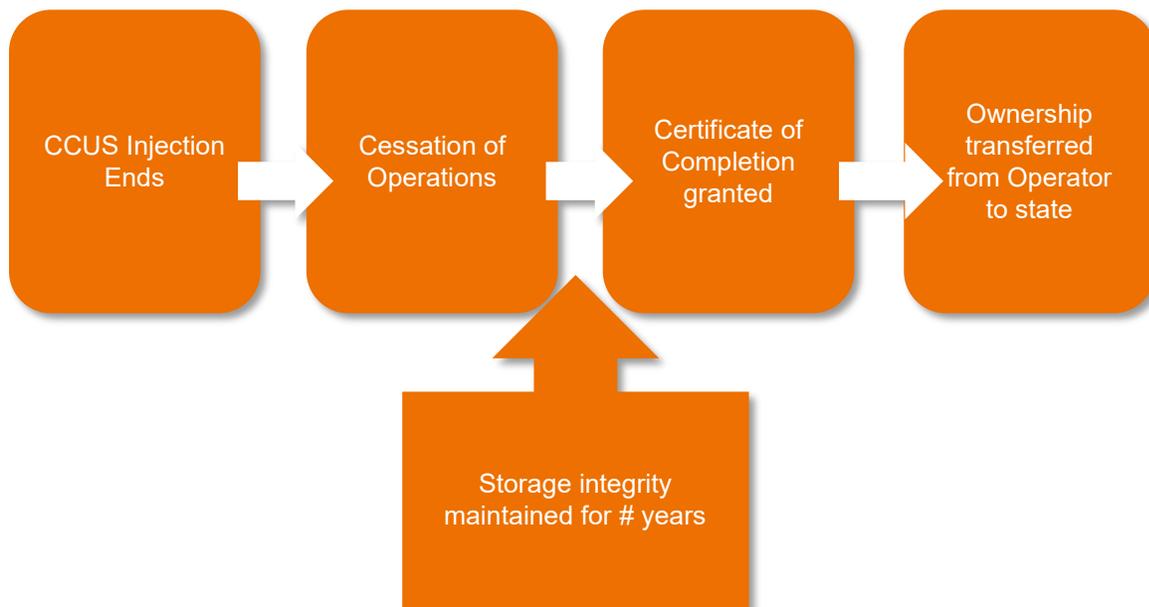


Figure 4 Certificate of Completion Flowchart

For each state, there is a range of minimum years required before the state issues a Certificate of Project Completion. The table below includes which States had explicit year requirements. A longer period between cessation and certification may reduce the chance of an accident while the state holds liability but may deter potential applicants, thus reducing the amount of CCUS injection well applications and its economic and environmental benefits. Regardless of the timeline for getting a Certificate of Project Completion, the EPA's Class VI UIC program requires monitoring of the storage site for 50 years after injection is complete before being considered complete for ownership transfer.

Under the Mines and Minerals Act of Alberta (Canada), the province requires the captured carbon dioxide to behave "in a stable and predictable manner, with no significant risk of future leakage" before assuming liability.



Table 30 Timeline for Certificates of Completion

State	Timeline for Certificate of Completion
Mississippi	3 years
North Dakota	10 years
Utah	10 years
Louisiana	10 years
Wyoming	20 years
Norway	20 years

Table 31 Certificates of Completion

State	Certificate of Completion
Wyoming SF 47 35-11-319 (a)-(b)	<p>“(a) After all carbon dioxide injections underground or into pore space are completed as provided by a permit issued under W.S. 35-11-313 and upon application by the injector holding title to the carbon dioxide under W.S. 35-11-318, the department may issue a certificate of project completion. The department shall only issue a certificate upon satisfaction of the conditions imposed under subsections (b), (c) and (d) of this section and after providing public notice of the application, an opportunity for public comment and a public hearing on the application.</p> <p>(b) A certificate of project completion shall not be issued until at least twenty (20) years after carbon dioxide injections end.”</p>
Louisiana H.B. 661 Section 1109. A. (1)	<p>“Ten years, or any other time frame established by rule, after cessation of injection into a storage facility, the Commissioner shall issue a certificate of completion of injection operations, upon a showing by the storage operator that the reservoir is reasonably expected to retain mechanical integrity and the carbon dioxide will reasonably remain emplaced, at which time ownership to the remaining project including the stored carbon dioxide transfers to the State. Upon the issuance of the certificate of completion of injection operations, the storage operator, all generators of any injected carbon dioxide, all owners of carbon dioxide stored in the storage facility, and all owners otherwise having any interest in the storage facility, shall be released from any and all duties or obligations under this chapter and any and all liability associated with or related to that storage facility which arises after the issuance of the certificate of completion of injection operations.”</p>

11 Environmental Protection Considerations

The Class VI rule for the UIC program was designed to protect underground sources of drinking water from long-term carbon sequestration, following the Safe Drinking Water Act. Since the UIC program is a federal program that includes environmental assessment, going through the NEPA process would be redundant. The Class VI permit application itself expands on those requirements to protect the environment around the project site through developing leading practices for siting, operation, testing, monitoring, and closure. For example, siting wells requires extensive site characterization of the affected environments.

States can choose to expand on the UIC requirements (which are already expanded from NEPA). In general, most jurisdictions rely on existing legislation, and adapt as needed, to regulate CCUS. For



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instance, in Alberta, Canada, many of the components of CCUS, including injection wells are permitted under the existing Oil and Gas Conservation Act and the Mines and Minerals Act. Environmental protection is also managed through the Environmental Protection and Enhancement Act, as well as numerous other acts and legislation that are already in place primarily to manage oil and gas and other resource developments. In addition, proponents are required to develop an MMV plan for the project that is subject to review by the Alberta Energy Regulator prior to its implementation.

Additional environmental considerations and protection efforts may include categorizing stored carbon dioxide, rehabilitating the land where a CCUS project took place, and refusing any level of risk to public health.

Table 32 Environmental Considerations

State	Environmental Considerations
<p>North Dakota S.B. 2095 38-22-12</p>	<p>"The commission shall take action to ensure that a storage facility does not cause pollution or create a nuisance. for the purposes of this provision and in applying other laws, carbon dioxide stored, and which remains in storage under a commission permit, is not a pollutant nor does it constitute a nuisance.</p> <p>2. the commission's authority in subsection 1 does not limit the jurisdiction held by the state department of health. nothing else in this chapter limits the jurisdiction held by the state department of health.</p> <p>3. the commission shall take action to ensure that substances that compromise the objectives of this chapter or the integrity of a storage reservoir do not enter a storage reservoir.</p> <p>4. the commission shall take action to ensure that carbon dioxide does not escape from a storage facility."</p>
<p>West Virginia H.B. 4491 §22-11B-8. (a)-(b)</p>	<p>"For the purposes of this article and in all other respects, any carbon dioxide injected and sequestered in accordance with an underground injection control permit issued by the secretary shall not be considered a pollutant and the operation and existence of such a carbon dioxide sequestration facility shall not be considered a public nuisance.</p> <p>(b) The secretary's and the commission's authority as set forth in this article shall not otherwise limit the authority or jurisdiction of the secretary and the commission in any manner."</p>
<p>Victoria, Australia Greenhouse Gas Geological Sequestration Act Division 2. 7</p>	<p>"The objectives of this Act are to encourage and promote greenhouse gas sequestration operations for the benefit of all Victorians by...establishing a legal framework for the legislation of greenhouse gas sequestration operations aimed at ensuring that...</p> <ul style="list-style-type: none"> (i) greenhouse gas sequestration operations are carried out in ways that minimise impacts on public health and the environment; and (ii) consultation mechanisms are effective and appropriate access to information regarding greenhouse gas sequestration operations is provided; and (iii) land affected by greenhouse gas sequestration operations is rehabilitated."
<p>Country of Norway Legislation of carbon dioxide Section 1-10</p>	<p>"A subsea reservoir shall only be selected as a storage location if there, under the conditions proposed for such use, is not a significant risk of leakage, and there is also not considered to be any risk of health or environmental damage of significance."</p>



12 Review Outcome: Primacy

Primary enforcement authority (“primacy”) refers to State, territory, or tribal responsibilities associated with implementing EPA approved UIC programs within that state, territory, or tribe. Delegating Class VI primacy to states helps alleviate the EPA’s workload. Self-regulating via primacy also gives power— although granted — back to the states. States seeking primacy must demonstrate the state has authority over underground injection, the state’s legislation meets the Safe Drinking Water Act Section 1422 requirements and have the capacity to fulfill administrative and enforcement duties. Writing robust legislation that follow the UIC program is one of many steps to program primacy.

Any state legislation implemented by Alaska would need to meet or exceed the EPA criteria for Class VI wells, including:

- Extensive site characterization requirements,
- Injection well construction requirements for materials that are compatible with and can withstand contact with carbon dioxide over the life of the project,
- CCUS injection well operation requirements,
- Comprehensive monitoring requirements addressing well integrity, carbon dioxide injection and storage, and ground water quality during the injection operation and the post-injection site care period,
- Financial responsibility requirements assuring the availability of funds for the life of the project (including post-injection site care and emergency response), and
- Reporting and recordkeeping requirements that provide project-specific information to continually evaluate Class VI operations and confirm protection of underground drinking water sources.

There are four phases of the Primacy application process.

- Phase I: pre-application activities (writing legislation reviewed in this document)
- Phase II: completeness review and determination
- Phase III: application evaluation
- Phase IV: rulemaking and codification

12.1 States with Primacy

North Dakota and Wyoming are the only states with Class VI primacy. A significant portion of the language used as examples in the previous section were from the two state’s legislations because they were the most robust out of all 11 states sampled. Louisiana, Texas, and West Virginia’s legislations closely followed the legislations of the primacy states and now those states are in the process of applying for primacy.



Arizona is in the Pre-Application Activities phase of applying for Primacy. West Virginia and Texas are in Pre-Application Activities phase of Program Revision Applications. Louisiana's Program Revision Application (for Class VI Primacy) is currently being evaluated.

12.2 Steps to Primacy and Timeline

The timeline to primacy is not consistent between states. The EPA originally estimated it would take 270 days for a state to apply and obtain Class VI primacy. While it took less than 3 months for the EPA to accept North Dakota and Wyoming's completed Class VI primacy applications, the evaluation process timeline varied. North Dakota's application took five years to be approved while Wyoming's application took six months to be approved (more aligned with the original estimation).

Louisiana submitted a completed Class VI primacy application in September 2021 and is still in the evaluation process (almost 400 days later). Arizona's timeline also lags the EPA's estimation and has been in the pre-application activity stage for four years (since 2018).

While creating state legislation may only take less than a year to write and pass, primacy has a longer, inconsistent timeline.

13 Summary of Major Issues

As noted in this report, there are several major issues to be addressed in developing CCUS legislation.

13.1 Pore space licensing

As previously stated, pore space ownership is not a clear and settled area of property rights law. Therefore, protocols for licensing pore space are also not clear or settled. Most states are primarily following the American rule, designating ownership of pore space (any geological formations below the surface) to the surface estate owners. However, there are two exceptions to the American rule. First, the surface owner does not have title to pore space if there has previously been a severance in the surface and subsurface estate (primarily for mineral extraction). And second, the surface owner may not own all the pore space if pore space is defined to exclude pore space created from mineral extraction activities. Utah follows this exception; all other states appear to assign all pore space to surface owners.

Pore space licensing in Alaska is already unique compared to the lower 48 states. According to the Alaska Constitution and the Alaska Statehood Act, natural and subsurface resources belong to Alaska. Oil and gas companies pay royalties on oil and gas production to ADNR and taxes to the Department of Revenue. Alaska's subsurface ownership is more like Norway and Canada than other American states. Since surface owners do not automatically own all geological formations below the surface, Alaska does not exclusively follow the American rule. If Alaska owns the subsurface estate, Alaska theoretically owns the pore space as well. Alaska may be able to lease the right to use pore space, just as the state leases the right to extract oil, gas, and minerals.



13.2 Amalgamation of Property Interests

As previously described, not every property owner needs to consent for a permit to be issued. The desired storage reservoir (comprised of pore space) for a CCUS project may be owned by multiple owners. Some owners may want to license pore space to a CCUS project while others may not. Since subsurface property is harder to delineate than surface property lines, a nonconsenting owner's pore space may not be separatable from the desired pore space reservoir. Therefore, states can amalgamate property, like they have the power of eminent domain. Amalgamating property interests refers to the government's right to order the pooling of the desired pore space licensing for a CCUS project in return for payment of compensation. The pore space owners still own their pore space, but the state may allow the pore space to be licensed to the project, with compensation. Alaska will need to determine its process for amalgamation and its minimum percentage of consenting pore space and surface owners. If it is determined that Alaska owns the pore space, this process may still focus on getting consent from the surface owners.

13.3 Class VI Primacy

Primary enforcement authority ("primacy") refers to state, territory, or tribal responsibilities associated with implementing EPA approved UIC programs within that state, territory, or tribe. The majority of the states do not have the authority to issue Class VI permits, leaving permitting responsibility with the EPA. Delegating Class VI primacy to states would help alleviate the EPA's workload and may speed up the permitting process back to the estimated 270-day timeline. To do so, states seeking primacy must demonstrate the state has authority over underground injection, the state's legislation meet the Safe Drinking Water Act Section 1422 requirements and have the capacity to fulfill administrative and enforcement duties. Earning primacy will likely take Alaska many years, based on how other states are moving slowly through the process.

13.4 Measurement, Monitoring, and Verification

Because of the propensity of sequestered carbon dioxide to migrate offsite the EPA's Class VI UIC program requires applicants to provide a site-specific "Testing and Monitoring Plan" to cover measurement, monitoring, and verification. These plans require narrative descriptions of a variety of techniques. Measurement, monitoring and verification of permit compliance is an important step to completing a project and ensuring environmental and human health.

Many states do not include detailed, explicit MMV requirements in state policy aside from including the act of "monitoring" in the duties of that state's authority. Monitoring is often referred to in legislation but does not have its own section or extra requirements from the state. This deference to state regulatory agencies could become a source of confusion when applying for CCUS permits.



13.5 Long Term Liability

Long term liability is a major regulatory challenge because of the novelty of geologic sequestration and the uncertainty about its long-term effects on human health and the environment. Even though many states have financial, temporal, and technical conditions a storage operator needs to meet before transferring liability of the CCUS site to the state government, there is still uncertainty if the conditions are enough to determine negligible risk. Therefore, liability is not guaranteed to be transferred after a project is completed. Some states require significantly endowed trust funds to address or remediate any duty, obligation, or liability that may arise after ownership is transferred to the state. These trust funds are industry's current best attempt to ensure liability will not be the burden of the state and people.

13.6 Mineral Interests

Mineral rights are the ownership rights to underground resources, including fossil fuels, ore, and mineable rocks. Mineral rights are a type of subsurface right, but it does not mean a holder of a mineral right has the right to the entirety of a subsurface property. A CCUS injection well and mineral extraction operation within the same property could be mutually exclusive. Therefore, states must address how the state will maintain the rights of both mineral rights owners and pore space owners. A mineral right is a much older and solidified legal concept than pore space, so it is imperative that Alaska prioritizes the holders of oil, gas, and mineral rights.

13.7 Fiscal Issues

States plan to impose fees at every stage of the CCUS injection well process to cover the costs of implementing a Class VI permitting program. Unique to other states, Alaska, specifically the AOGCC, receives funding from revenue of oil and gas production. If this revenue modeled was followed for the Class VI permitting program, it would take many years to receive those fees. Therefore, temporary funding may be needed to cover the initial expenses of implementing the program until those revenue fees can be taken. These fees are intended to be deposited in designated administrative and trust funds to facilitate CCUS injection wells and the program. To address concerns about uncertainty of long-term liability, trust funds hold money for long-term monitoring and management of a closed facility. Alaska will need to structure funding for this program to work.

Alaska's Corporate Income Tax adopts the Federal Income Tax Code without modifications or exceptions, so any Alaska-based taxpayer is eligible to earn the Federal 45Q Tax Credit. Alaska could continue to recognize the Federal 45Q Tax Credit or de-couple from it and adopt an alternative system.

If Alaska treats 45Q tax credits (or cash refunds) as other federal tax credits, the State could increase its corporate income tax revenue.



14 Conclusion

Most legislation reviewed for this report were initially written circa 2010 and amended throughout the next decade. When amending legislation, states appear to follow the lead of the two states with Class VI primacy: North Dakota and Wyoming. Slight variations occur with timelines and requirements, but most legislations are similar. Alaska will be able to take note of these similarities and apply it to its unique management of natural resources.

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APPENDIX



Appendix A Recommendations

Successful development of CCUS projects in Alaska will require state primacy of Class VI underground injection well permitting, since the EPA is unlikely to permit Class VI wells in Alaska in a timely manner and in sufficient quantity to support a nascent industry within the state. The implementation of some form of bridge funding to subsidize program development and initial operation will also be needed to cover program costs until there is sufficient funding from industry to support the state's Class VI well program.

CCUS is a relatively new and rising industry and the slow permitting of Class VI injection wells by the EPA compared to states that have primacy means that states that do not have primacy will be at a disadvantage in attracting CCUS projects. Recent decisions at the federal level, such as the 45Q tax breaks and the administration's plan to reduce GHG, will spur relatively rapid growth of CCUS projects.

A recommended first step would be a legislative bill package authorizing a state agency, preferably AOGCC, to investigate Class VI primacy. This bill package would need to include statutory language defining pore space and other CCUS concepts addressed in this report, establish state authority over pore space on state and private lands and vest AOGCC with that authority, address preservation of existing rights, and provide agency funding to investigate primacy. There may be additional federal funding available for this effort, and coordination with Alaska's Congressional delegation would be needed. Title III of the Infrastructure Investment and Jobs Act (H.R. 3684) provided some funding for this effort, and there are several bills currently in committee that address CCUS (e.g., H.R. 8337 and H.R. 3039).

The state received primacy over Class II injection wells in 1991, but that process has little relevancy to a future Class VI primacy project. A better model might be ADEC's program to gain primacy over National Pollutant Discharge Elimination System (NPDES) permitting in Alaska. A review of other states' experiences in achieving primacy would also be useful. EPA has indicated that the pathway to state primacy takes approximately 270 days, but the experiences of the states with primacy vary widely.

Development of legislations to support the state's application for primacy would also be needed. This report can serve as a compendium of state legislations to support development of Alaska legislations, identifying the relevant issues and providing example language. There is a significant corpus of model and existing legislations that can be utilized in legislations development.

In the interim, carbon dioxide injection for EOR under the Class II UIC well program can be currently permitted by the state. The EPA has ruled that carbon dioxide injection for EOR, whether using anthropogenic or non-anthropogenic sources of carbon dioxide, can be covered under the Class II permit system and that Class II wells can be transitioned to Class VI wells if EOR ends and the quantities of carbon dioxide being sequestered increases the risk to underground drinking water reservoirs. This should only be considered as an interim measure as the requirements for Class VI wells, particularly in siting and construction, are significantly different from Class II wells.

