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Comparative Analysis of Statutory and Regulatory Frameworks for Geologic Carbon Sequestration

Seth Blumsack*, Michael Helbing, Hannah Wiseman, Sarah Yu, Farangiz Bakhtiyorova, Braden Amspacher, Pennsylvania State University.

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Abstract

Substantial risk in planned geologic carbon storage (GCS) projects arises from vague legal regimes for subsurface property rights, conflicts among subsurface users, and complex permitting and regulatory requirements. In the United States, most of these requirements are imposed by states, some of which are developing new policies. Some states are adopting similar practices in their policies, leading to a relatively uniform legal landscape. In other areas, states' approaches diverge from their peers, creating the potential for confusion and delay. Moreover, elements of GCS policy in some states could be improved with greater integration of emerging scientific knowledge. Our work provides a comparative analysis of U.S. state-level law—statutes, regulations, and court decisions—focused on GCS. It highlights similarities and conflicts among state approaches, identifies potential legal roadblocks to GCS, and suggests better, scientifically informed paths forward.

Introduction

Geologic Carbon Sequestration (GCS) in the United States is a relatively new activity in practice. The injection of natural or captured CO₂ has been employed for many decades in the context of enhanced oil recovery (EOR; API, n.d.), and CO₂-EOR has accounted for hundreds of thousands of barrels of U.S. oil production per day (NETL, 2015). The injection of CO₂ into subsurface formations for long-term geologic storage has long been considered a critical technology to enable lower-carbon energy transitions (Menefee, et al., 2024), and research has suggested substantial technical potential for GCS in North America (USGS, 2019). As of the end of 2025, however, the U.S. has permitted only around 30 GCS injection wells (U.S. Energy Association, 2025; U.S. EPA, 2026a). While dozens of additional GCS

permits are in various stages of review at the time of this writing (U.S. EPA, 2026a), the total injection capacity represents a small fraction of U.S. greenhouse gas emissions.

GCS projects carry risks that are technical, economic and regulatory in nature (Morgan, et al., 2012). This paper is focused on the regulatory environment for GCS projects. The U.S. Environmental Protection Agency regulates GCS activities under the Underground Injection Control (UIC) program, which is meant to protect underground sources of drinking water pursuant to the Safe Drinking Water Act (U.S. EPA, 2026c). The UIC program regulates and issues permits for many different classes of subsurface injection activity; GCS activities require a “Class VI” permit, specifically designed for the permanent subsurface storage of CO₂. While the requirements for a Class VI permit are designed by the EPA, states may apply to the EPA for “primacy,” under which states develop an EPA-approved framework for reviewing and issuing Class VI permits themselves (U.S. EPA, 2026b).

Beyond complying with federal requirements, GCS projects also face various forms of regulation at the state and local level and may need to work with private parties to obtain property rights under state property law. Even with a Class VI permit in hand, GCS project operators may need additional types of permits from the state in which injection is occurring; will have to acquire subsurface property rights in compliance with state law; and may face different liability regimes depending on where injection is occurring. The legal and regulatory environment in which GCS activities are occurring is rapidly changing as states develop and revise statutes and regulations that govern GCS activities specifically.

Methods

We conducted a fifty-state review of existing and proposed statutory and regulatory frameworks and court decisions. This review was performed using legal databases such as LexisNexis and Westlaw, as well as publicly available sites such as Justicia. To identify legislation that had been proposed but not yet enacted, we searched state legislative websites for full text of proposed bills.

We documented our results in a spreadsheet file that included full text of applicable provisions (or a short summary in cases of lengthy provisions) and citations. For instances in which material was searched for but not located, we entered “data not located” into the spreadsheet, indicating a likelihood that the state being researched had not yet addressed a particular issue.

Our review focused on a variety of different legal and regulatory dimensions, including:

- The status of state primacy applications for Class VI injection permits;
- Whether states have frameworks for assigning the ownership of subsurface pore space (i.e., whether pore space ownership is vested in the surface or subsurface property rights owner) and how pore space ownership is conveyed (transferred from one party to another upon sale of the surface or subsurface property rights);
- The extent, if any, of mandatory pooling provisions or unitization for the purpose of GCS;
- Dominance of use of the subsurface for mineral extraction or GCS, specifying which activity takes priority and under what circumstances, when conflicts arise;
- Insurance or bonding requirements for GCS operators;
- Timing and process for the transfer of leakage liability from the GCS operator to the state, following the cessation of injection;
- Regulations specific to induced seismicity; and
- Public participation requirements for permitting and regulatory processes.

Discussion

In reviewing state statutes and regulations related to or specifically aimed at GCS, we have uncovered some aspects where state approaches are highly uniform and some where state approaches are highly varied. This is true even when looking at states that are strong candidates for GCS and have or have not applied for or achieved Class VI primacy from the EPA.

We see the greatest degree of uniformity in how states treat property rights for subsurface pore space and in the area of dominance of the mineral estate. Nearly all U.S. states with explicit subsurface pore space ownership structures follow the “American Rule” in defining pore-space property rights, under which property rights accrue to the surface owner rather than the subsurface mineral owner. Only one state in our review, Alaska, follows the “European Rule” in assigning pore space property rights expressly to the owner of the mineral estate. Of states having structures explicitly assigning dominance to mineral extraction activities versus subsurface storage, most favor the existing mineral estate. Colorado appears to be one example that explicitly does not assign dominance to mineral extraction, while Louisiana’s structure is more vague, stating, “[t]he surface owner and the mineral owner must exercise their respective rights with reasonable regard for those of the other.” (LA Rev Stat § 31:11.A (2024).)

We see a greater degree of variation in most other dimensions of GCS statute and regulation. States both within and between basins have widely varying approaches and requirements for mandatory pooling, the transfer of post-injection liability to the state, and public participation requirements in the issuance of a GCS permit. States also vary in the level and number of regulatory requirements needed by GCS developers in addition to the issuance of a Class VI injection permit.

Variation within geologic basins is particularly striking. Our prior work (Menefee, et al. 2024; Wiseman, et al. 2025) has suggested substantial cost and procedural advantages to harmonizing GCS requirements and activities at the basin level rather than individual states developing regulatory structures completely independently.

Conclusions

GCS developers in the U.S. face a wide array of varied state rules and regulations in developing sequestration projects, and also face an array of different divisions of federal and state responsibility for GCS permit issuance (based on whether a state has Class VI primacy). Given that geologic basins amenable to GCS cross state and other jurisdictional boundaries, this variation in state approaches has the potential to raise costs. The development of these varying state approaches may themselves be rooted in different policy, economic, or technical objectives. We are following up on this legal research with stakeholder interviews in several U.S. states to uncover the factors driving adoption of differently-structured GCS statutes and regulations.

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