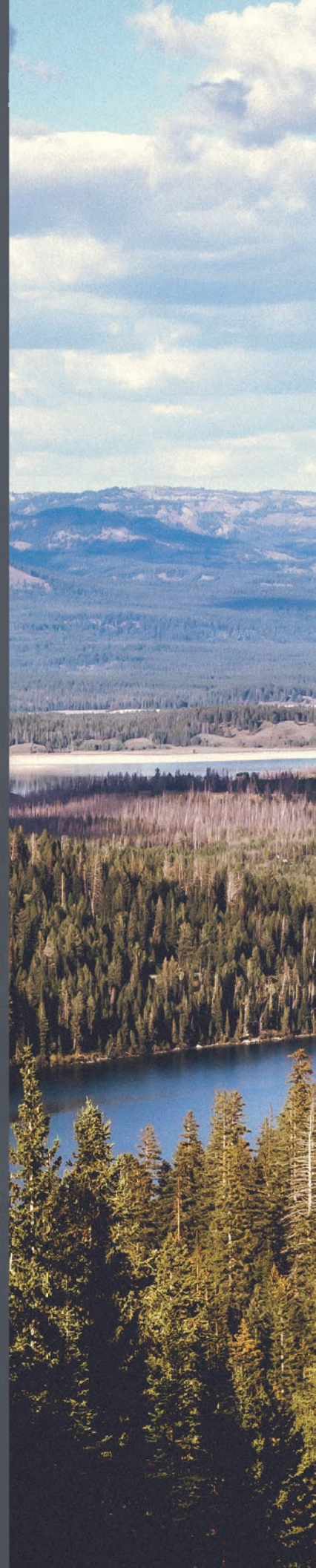


Regulatory Considerations for Carbon Dioxide Storage and Plume Migration on Interstate and Federal Lands

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Selena Gerace

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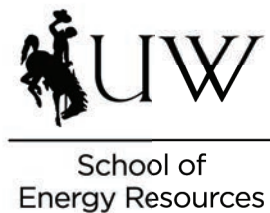
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Partnership and Collaborations

Plains CO₂ Reduction Partnership (PCOR) collaboration with the Wyoming Department of Environmental Quality and University of Wyoming School of Energy Resources



About the School of Energy Resources (SER)

SER collaborates with stakeholders at the state, national and international levels to advance energy technologies and policies to grow and support Wyoming's robust energy sector. SER's mission is to promote energy-driven economic development for the state, and it leads the University of Wyoming's talent and resources for interdisciplinary research and outreach, fulfilling Wyoming's promise to be a global leader in a thriving and sustainable energy future.

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DEFINITIONS AND ABBREVIATIONS

AREA OF REVIEW (AOR)

The subsurface three-dimensional extent of the carbon dioxide plume, associated pressure front, and displaced fluids, as well as the overlying formations, and surface area above that delineated region.

CLASS VI WELL

One of six classes of wells under the Underground Injection Control (UIC) program, generally permitted by EPA, that are used to inject carbon dioxide (CO₂) into deep rock formations for permanent geologic storage.

CARBON CAPTURE AND STORAGE (CCS)

Refers to a process by which carbon dioxide (CO₂) is captured from the atmosphere or an anthropogenic point-source and injected deep geological reservoirs through one or more injection wells for long-term or permanent storage. Comparatively, carbon capture, utilization, and storage (CCUS) may refer to CCS more broadly, also encompassing CO₂ injections for enhanced oil recovery (EOR).

CO₂ PLUME

“[T]he extent underground, in three dimensions of an injected carbon dioxide stream.” 40 C.F.R. § 146.81.

PRIMACY

Primary enforcement authority is delegated by EPA to individual states, territories, or tribes, granting the jurisdiction authority to administer certain well classes in the UIC program in accordance with federal standards.

*This paper adapts portions of an article by co-author M. Lewis, *The Space Between Us: Transboundary Challenges of Geologic Carbon Storage in Interstate and Federal Pore Space*, published in OIL, GAS & ENERGY LAW 3 (2023).



INTRODUCTION

Wyoming is one of the largest emerging hubs for carbon capture and storage (CCS) infrastructure projects. CCS refers to a process in which carbon dioxide (CO₂) is captured from either the atmosphere or an industrial point source (such as a coal or natural gas power plant) and injected into reservoirs deep underground (pore space) for permanent storage. CCS technologies offer key benefits on a global scale by removing excess amounts of CO₂ in the atmosphere. CCS also poses an important economic opportunity for Wyoming, helping the State manage carbon associated with its fossil fuel industry, and therefore aiding in the preservation of the strong oil, gas, and coal economies that have supported the State for decades.

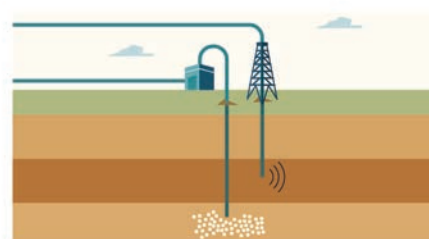
Both the International Energy Agency (IEA) and the Intergovernmental Panel on Climate Change (IPCC) recognize CCS as an essential climate change mitigation strategy for meeting global greenhouse gas emission reduction targets.¹ Yet, according to the IEA, additional efforts are still needed to bring CCS to a broad scale.² Wyoming, with its extensive deep subsurface saline storage reservoirs and an existing network of CO₂ pipelines, is suited to embrace this opportunity. However, despite Wyoming's efforts to proactively establish a favorable regulatory and statutory framework for the development of its pore space, the challenge of widespread CCS deployment is ultimately a regional one, requiring coordination with Wyoming's neighboring states and numerous federal land agencies to mobilize the high volume of shared pore space resources that transcend state boundaries.



1 CAPTURE CO₂ at the source (power plants or coal-based facilities) instead of releasing it into the atmosphere



2 TRANSPORT the CO₂ to an injection site (usually by pipeline)



3 STORE the CO₂ permanently in geologic layers thousands of feet underground

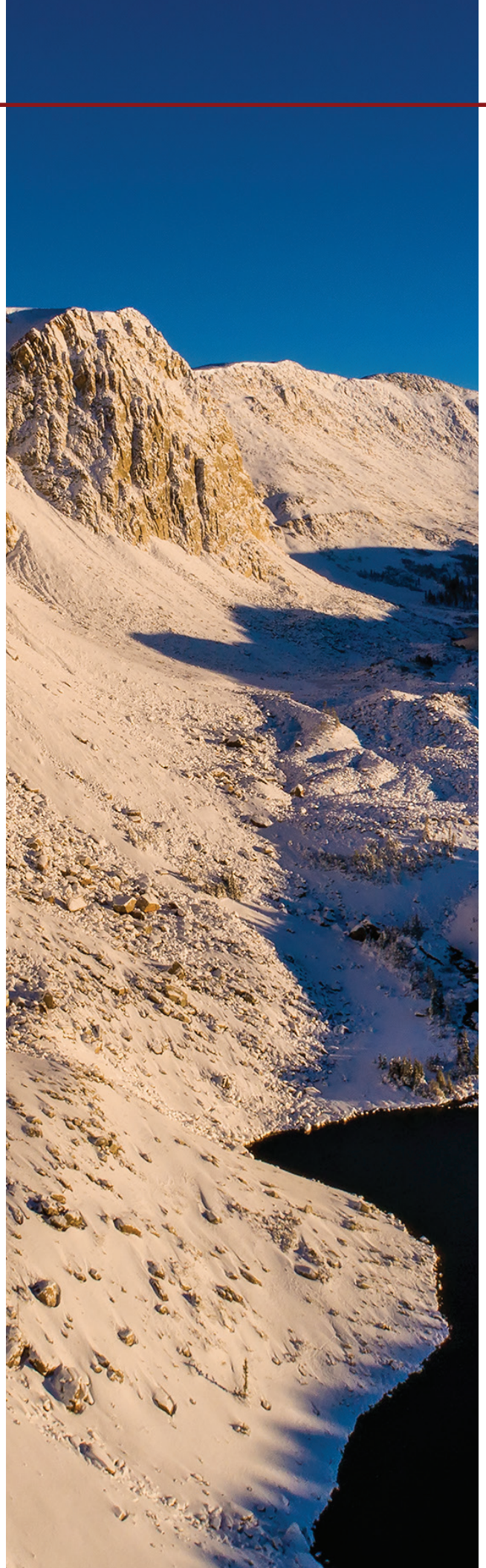
Via CCUS, CO₂ can also be captured, transported, and utilized for commercial purposes such as EOR. For purposes of clarity around the regulatory framework specific to Class VI wells, rather than the Class II wells used for EOR, this paper focuses exclusively on the storage aspects of CCUS (aka, CCS).

¹ International Energy Agency, Energy Technology Perspectives 2020 (2020); Intergovernmental Panel on Climate Change, Special Report: Global Warming of 1.5 C, Summary for Policymakers (2019).

² International Energy Agency, Carbon Capture, Utilization and Storage (Tracking Report) (2022).

Since 2010, Wyoming has taken significant steps to establish a cohesive statutory and regulatory framework to streamline the permitting process to facilitate carbon management through CCS. However, although Wyoming generally has jurisdiction to control and promote carbon management-related injection activities within its borders, the state's CCS industry hinges in part on regional challenges extending beyond its geographic footprint. For instance, almost half of all surface land area in Wyoming is owned and managed by the federal government. Moreover, several areas of high storage potential traverse state boundaries, overlapping with regions of Colorado, Montana, Nebraska, and South Dakota, sparking questions about the potential for storage activities within interstate pore space. It has become increasingly clear that storage projects in Wyoming will require cooperation with relevant federal land agencies and neighboring states to resolve and clarify issues relative to the use of interstate and federal lands for CCS.

This report sets forth an overview of regulatory considerations surrounding the development of interstate pore space, as well as pore space under federal lands. **Section II** of this report (“Background”) provides an update on Wyoming's CCS statutory and regulatory framework, legislative progress, and receipt of Class VI primacy designation, as well as challenges relative to the state's utilization of interstate and federal pore space. Subsequently, **Section III** briefly overviews the basic pillars of state-level CCS regulation, including: 1) Class VI enforcement authority; 2) pore space ownership; 3) pore space unitization; 4) long-term stewardship of geologic storage facilities; 5) pore space versus mineral estate dominance; and 6) subsurface trespass liability. For each pillar, we include an overview of applicable statutes and regulations (if any) promulgated in Wyoming's neighboring states. **Section IV** provides an overview of regulatory considerations related to the geologic storage of CO₂ on federal lands located in Wyoming. Finally, **Section V** concludes by illustrating hypothetical, but potentially likely scenarios for consideration by policymakers and regulators.





BACKGROUND

WYOMING'S LEGAL LANDSCAPE FOR CCS

Since 2010, the State of Wyoming has passed comprehensive legislation to allow and promote CO₂ storage. Within Wyoming's framework, prospective CO₂ storage operators have the opportunity to pursue CCS in an environment with well-defined risks and liabilities. In 2020, the U.S. Environmental Protection Agency ("EPA") granted the Wyoming Department of Environmental Quality (WDEQ) primacy over the federal underground injection control (UIC) "Class VI" well program, governing injection wells for CO₂ storage and storage. Wyoming statutes and regulations: 1) localize and streamline the storage process by authorizing the WDEQ to oversee CCS injection permitting in Wyoming; 2) provide clarity for the ownership and leasing of pore space by establishing a regime for the ownership and conveyance of pore space rights; 3) create efficiencies by authorizing multiple pore space interests to be combined for development as a single unit (unitization); and 4) allocate responsibility for long-term stewardship of and liability for geologic storage facilities.

Each component of Wyoming's CCS policy is supported by legislative intent to foster the widespread deployment of CCS across the State. However, despite obtaining primacy over its Class VI program and establishing a favorable regulatory

environment for CCS, the footprint of high-potential storage facilities, injected CO₂ plumes, and pressure fronts may not always align with Wyoming's borders, instead intersecting with numerous state boundaries and federal land holdings.

INTERSTATE CHALLENGES

Indeed, several of the highest-storage-potential basins in Wyoming traverse or are situated near state borders, including the Greater Green River Basin extending into Colorado and Utah, the Bighorn and Powder River Basins extending into Montana, and the Denver basin extending into Nebraska and Colorado. (See *Figure 1*). Once injected into the subsurface, CO₂ can also migrate through rock formations and other subsurface pathways in ways that may not be fully predicted by plume modeling. As a result, there is the potential (however slight) for CO₂ to cross property boundaries and migrate into areas where the injector does not have ownership rights, raising potential concerns of trespass liability. Yet, as Wyoming is only one of two states with Class VI primacy,³ and as its neighboring states, including Colorado, South Dakota, Idaho, and Utah have yet to establish key policy frameworks to govern CCS within their jurisdictions, there is little guidance and precedent to aid Wyoming in resolving interstate issues that may arise in the course of expansion of its CCS industry.

³ North Dakota obtained Class VI primacy in 2018. <https://www.dmr.nd.gov/dmr/oilgas/ClassVI>.

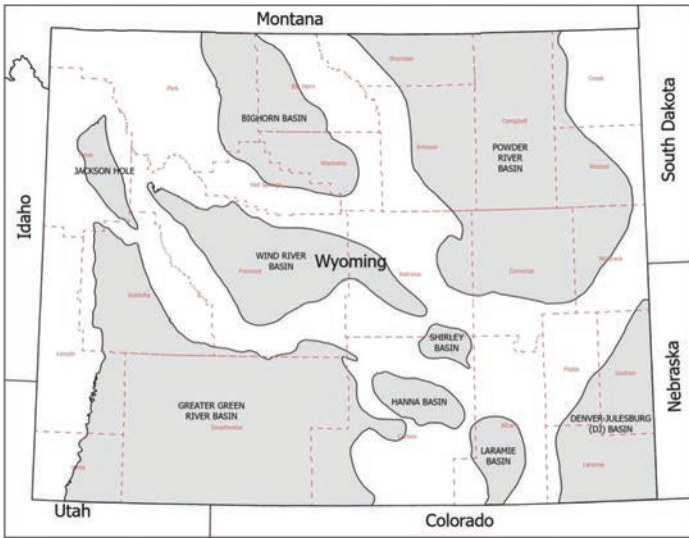


Figure 1: Sedimentary basins in Wyoming.⁴

FEDERAL LANDS CHALLENGES

In addition to challenges emanating at state boundaries, Wyoming also faces legal and regulatory uncertainties in relation to intersections with federally owned pore space. Nearly 50% of the surface land area in Wyoming is federally owned, mostly by the Bureau of Land Management (BLM) and the United States Forest Service (USFS) (see Figure 2).⁵ Federal ownership is especially concentrated in many of the basins with a high carbon dioxide storage potential. Even where proposed injection sites lie on privately-owned land, the immense scale of CCS projects and the size of underground carbon dioxide plumes means the area of review for each site is likely to overlap with federal parcels owned in fee or split estate lands. For example, the Greater Green River Basin is almost 68% federal land. (See Table 1). And, while the Powder River Basin has a lower percentage of federally owned surface land, it has a large

number of split estates, where the surface rights are privately owned, but the mineral rights are federally owned, empowering various federal agencies’ authority over the pore space.

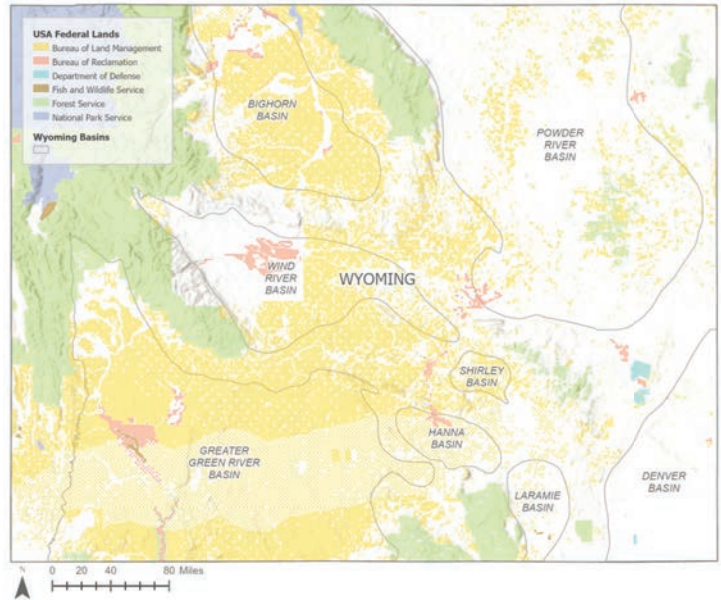


Figure 2: Federal lands in Wyoming basins.⁶

Percentage of Surface Land in Wyoming Basins that are Federally Owned

Powder River Basin	17%
Greater Green River Basin	68%
Laramie Basin	9%
Hanna Basin	41%
Shirley Basin	65%
Denver Basin	1%
Wind River Basin	39%
Bighorn Basin	72%

Table 1: Wyoming Basins owned by the US Federal Government⁷

⁴ Map obtained from Wyoming Department of Environmental Quality.

⁵ Data Sources: Esri, BLM, BoR, DoD, NPS, USFWS, USFS, USGS, Wyoming State Geological Survey.

⁶ Data Sources: Esri, BLM, BoR, DoD, NPS, USFWS, USFS, USGS, Wyoming State Geological Survey.

⁷ 40 C.F.R. § 144.12.



REGULATORY CONSIDERATIONS RELATED TO INTERSTATE STORAGE

Laws addressing Class VI primacy, pore space ownership, pore space unitization, and long-term stewardship and liability are foundational components of Wyoming’s CCS policy architecture. These laws assign agency authority to permit CO₂ injections for CCS, clarify the ownership regime for a relatively nascent property right, facilitate efficient pore space utilization via unitization, and delegate responsibility for long-term stewardship of storage sites to ensure operators do not face liability in perpetuity. However, several of Wyoming’s neighboring states have yet to address any of these issues. As a result of these regulatory gaps, much of Wyoming’s available pore space may be rendered unusable to the extent it overlaps with or approaches state boundaries.

CLASS VI PRIMACY

CCS injection wells are administered under Class VI of the EPA’s Underground Injection Control (UIC) program.⁸ EPA’s Class VI authority derives from its roots in the Safe Drinking Water Act (SDWA), which is designed “to assure that underground sources of drinking water [USDWs] will not be endangered by any underground injection.”⁹ EPA’s Class VI program requirements are minimum standards for any covered UIC well program, and EPA may transfer its jurisdiction over one or more well classes to state agencies that have developed state-level programs in compliance with EPA’s minimum UIC standards.⁶ In other words, states that establish UIC programs within or exceeding the parameters set by EPA may apply to the EPA for primacy to administer their own programs under one or more UIC classes.⁷ States may wish to obtain primacy for a variety of reasons, including but not limited to centralizing and greatly streamlining the Class VI application process.¹⁰



⁸ In addition to Class VI wells, Class II wells also involve the permanent underground injection of CO₂, but in relation to oil and gas operations (including injections for enhanced oil recovery). “Class VI” wells, conversely, are specifically designed for the injection and long-term storage of CO₂.

⁹ 40 C.F.R. § 144.12.

¹⁰ For instance, while over 160 Class VI well permits spanning 57 different projects have been submitted to EPA at the time of this report, none have been approved. <https://www.epa.gov/uic/current-class-vi-projects-under-review-epa>



The extent to which states with Class VI primacy are required to coordinate with EPA regarding the interstate implications of injection activity is not immediately clear from the relevant statutes and regulations, which only require Class VI injectors to “notify” EPA when the area of review for an injection site encompasses a state without primacy.¹¹ Areas of review encompass the footprint of not only the injection reservoir, but also a buffer zone that includes the three-dimensional extent of the carbon dioxide plume, associated pressure front, and displaced fluids, as well as the overlying formations, and surface area above that delineated region. This means that even if an injection well is sited in Wyoming, Wyoming CCS operators may still be required to conduct potentially burdensome interface with EPA for injection wells that are located near state(s) without primacy, as well as for wells near federal land holdings.

At the same time Class VI provisions could, in theory, require Wyoming operators to interface with the EPA in addition to state regulators, despite the state’s primacy status, the scope of Class VI primacy is also limited. The purview of Class VI encompasses only CO₂ injections, leaving geologic storage through the use of pore space to state law and regulation. This means that within the states without primacy (all but Wyoming and North Dakota as of late 2023), prospective CO₂ storage operators must apply to the EPA for injection permits, then look to state procedures for identifying, leasing, and unitizing pore space interests for storage.

To date, twenty-five states and two Tribes have obtained primacy to administer their own Class II injection programs. However, only two have received primacy over their Class VI programs. North Dakota became the first state to obtain Class VI primacy in 2018,¹² with Wyoming following closely behind in 2020.¹³ As of this report, no Class VI permits have yet been approved in Wyoming, but several are currently under review with WDEQ.¹⁴ In 2021, Louisiana’s Department of Natural Resources, became the third state to apply for primacy.¹⁵ None of Wyoming’s neighboring states have applied for Class VI primacy.

¹¹ See 40 C.F.R. § 146.82 (requiring state UIC program directors to “notify, in writing, any States, Tribes, or Territories within the area of review of the Class VI project”).

¹² 83 Fed. Reg. 17758 (2018).

¹³ 85 Fed. Reg. 64053 (2020).

¹⁴ Wyoming Department of Environmental Quality, Class VI (n.d.).

¹⁵ See *supra* n. 11.

State

Status of Class VI Primacy in Wyoming and its Neighboring States

Colorado	Colorado has not applied for nor obtained Class VI primacy. In 2021, however, Colorado Oil & Gas Conservation Commission, Department of Natural Resources, submitted its legislative proposal, <i>Creating Colorado’s Carbon Sequestration Framework: A Legislative Proposal</i> (hereinafter the “COGCC Report”), to address the legal changes necessary to achieve a comprehensive regulatory regime for CCUS in Colorado. The proposal identified recommendations to seek primacy over Class VI wells. ¹⁶
Idaho	Idaho has not applied for nor obtained Class VI primacy.
Montana	Montana has not applied for nor obtained Class VI primacy.
Nebraska	Nebraska has not applied for nor obtained Class VI primacy.
South Dakota	South Dakota has not applied for nor obtained Class VI primacy.
Utah	Utah has not applied for nor obtained Class VI primacy, but has provided that the Utah Division of Oil, Gas, and Mining will undertake exclusive Class VI permitting jurisdiction should Utah obtain primacy in the future. ¹⁷
Wyoming	Wyoming obtained primacy over its Class VI program in October 2020. Its program is administered by the Wyoming Department of Environmental Quality. ¹⁸

¹⁶ The COGCC’s report details Colorado’s general absence of regulatory guidance, explaining the potential issues for CCS and recommending legislation to open geologic storage pathways. Requirements, Resources, Considerations, and Recommendations for the State of Colorado to Implement a Safe and Effective UIC Class VI Program, COLORADO OIL & GAS CONSERVATION COMMISSION (2021) <https://cogcc.state.co.us/documents/library/Technical/UIC/COGCC%20Class%20VI%20Report.pdf>.

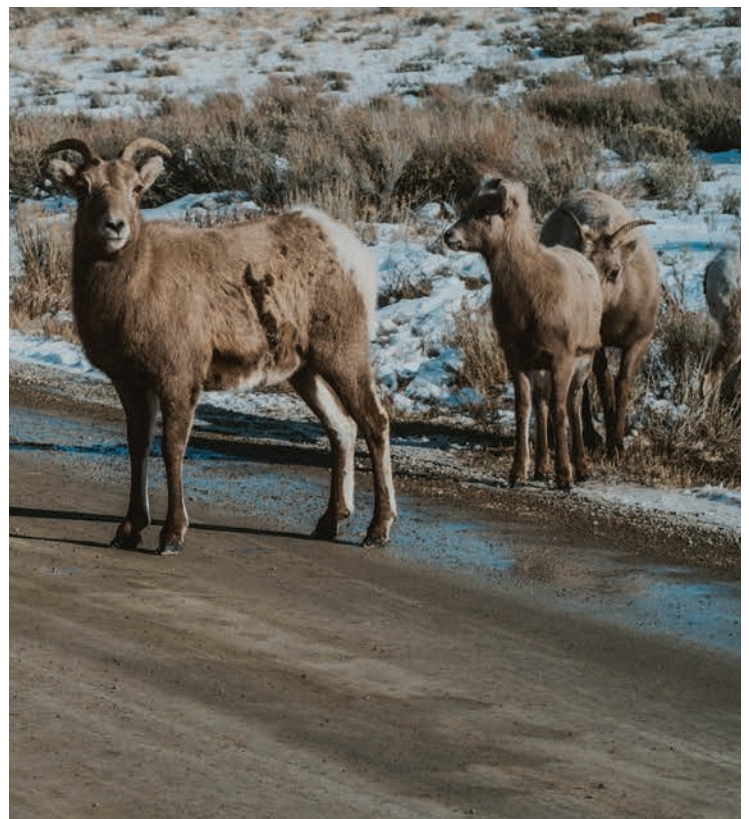
¹⁷ UTAH CODE ANN. § 40-11-3.

¹⁸ 47 Fed. Reg. 52434 (1982).

PORE SPACE OWNERSHIP

Real property ownership, including ownership of subsurface pore space, is generally a matter of state law. In states with split estate acts that allow separate ownership of the mineral and surface estates, such as Wyoming and all of its neighboring states, it is generally the prerogative of state legislatures to determine whether ownership of the pore space should be vested with the surface or mineral owner and set forth requirements for title conveyances, similar to those that govern the severance and conveyance of the mineral estate.¹⁹ Yet, many states have not yet articulated a definition of pore space, much less an ownership or leasing regime, creating a significant challenge for operators seeking to develop pore space in those jurisdictions.

Wyoming law vests ownership of the pore space with the owner of the overlying surface estate and also allows it to be severed and separately conveyed.²⁰ Of the states that border Wyoming, only Montana and Nebraska have established an ownership framework for pore space, both adopting a position similar to Wyoming.



¹⁹ In the absence of legislation to establish pore space ownership, the majority of states considering the issue under common law have resolved the question in favor of the surface owner. However, an increasingly small minority of case law signals the possibility for pore space ownership to vest in the mineral owner of a split estate. For a discussion of those cases, see Bruce M. Kramer, *Horizontal Drilling and Trespass: A Challenge to the Norms of Property and Tort Law*, 25 *COLO. NAT. RESOURCES, ENERGY & ENVTL. L. REV.* 291, 294 (2014) (“[At common law] [t]here is no simple answer to the question of who owns the pore space or the “rock” after there has been a severance.”).

²⁰ WYO. STAT. ANN. § 34-1-152.

State Status of Pore Space Ownership in Wyoming and its Neighboring States

Colorado	Colorado has not enacted statutes nor promulgated regulations to define pore space, establish whether pore space ownership is vested with the owner of the correlating surface or mineral estate, or regulate the severance of pore space. However, in its 2021 report, the COGCC recommends the Colorado Legislature enact legislation to vest the surface owner with ownership of the underlying pore space, unless it has been expressly conveyed and that pore space may be severed from the surface estate and transferred in the same way as mineral rights. ²¹
Idaho	Idaho has not enacted statutes nor promulgated regulations to define pore space, establish whether pore space ownership is vested with the owner of the correlating surface or mineral estate, or regulate the severance of pore space.
Montana	If the ownership of the geologic storage reservoir cannot be determined from the deeds or severance documents related to the property by reviewing statutory or common law, it is presumed that the surface owner owns the geologic storage reservoir. ²²
Nebraska	Pore space ownership is vested in the owner of the surface estate unless severed and separately conveyed. ²³
South Dakota	South Dakota has not enacted statutes nor promulgated regulations to define pore space, establish whether pore space ownership is vested with the owner of the correlating surface or mineral estate, or regulate the severance of pore space. In 2020, South Dakota Senate Bill 63 proposed vesting ownership of pore space with the surface owner, but the bill was deferred indefinitely. ²⁴
Utah	Utah law vests title to pore space underlying in the owner of the surface estate. ²⁵
Wyoming	Pore space ownership is vested with the owner of the overlying surface estate. Pore space interests may be severed and separately conveyed from the surface estate and are presumed to pass with the surface estate in conveyances unless severed. ²⁶

²¹ See supra n. 15.

²² MONT. CODE. ANN. § 82-11-180(3).

²³ NEB. REV. STAT. ANN. § 57-1604.

²⁴ S.D. S.B. 63 (2020)

²⁵ UTAH CODE ANN. § 40-6-20.5.

²⁶ WYO. STAT. ANN. § 34-1-152.

UNITIZATION OR AMALGAMATION

Once pore space ownership in each project area is identified, storage operators must then negotiate and obtain appropriate pore space leases for storage of CO₂. If an operator is unable to obtain the consent of all affected landowners, its only remedy may be unitization (aka “amalgamation”). Unitization, which refers to the process by which various parcels and interests can be combined for development as a single coordinated unit, is a familiar process within the oil and gas industry. In the oil and gas context, unitization developed as a tool to coordinate development among many interest owners, maximize resource recovery from a common reservoir, streamline production, and prevent a single owner from blocking development.²⁷ In the context of geologic storage, unitization would facilitate the same ends of efficiently developing a common geologic reservoir and promote the sharing of benefits and facilities among many owners within a geologic storage complex. However, the application of unitization procedures to pore space is still nascent. In general, states that have addressed the issue require a high threshold of landowner consent before the relevant regulating agency will order unitization. For example, the Wyoming Oil and Gas Conservation Commission (WOGCC) is authorized to approve a unit application only if the unit application is supported by the consent of 80% of the affected pore space owners.²⁸



Unitization serves a critical role in large-scale project development for CCS, functioning as the primary mechanism by which operators can consolidate multiple interests to develop pore space in an economically and geologically feasible manner. In the absence of compulsory unitization mechanisms, a single interest owner may be empowered to derail an entire project, posing potentially significant obstacles for the effective utilization of pore space resources and the widespread deployment of CCS. Yet even in states that have passed pore space unitization frameworks, it is unclear how different states’ frameworks would interface with one another in the event of an interstate storage facility, particularly in terms of the consent threshold required for unitization to occur where state laws conflict on the matter. Moreover, no mechanisms currently exist for the unitization of federal pore space with state or privately held lands, generating a significant obstacle for the development of federal pore space.²⁹

Of Wyoming’s neighboring states, only Nebraska and Utah have adopted unitization legislation, although Montana has also adopted a contingency provision authorizing pore space unitization in the event Montana is granted Class VI primacy.

²⁷ Joel Mack and Chelsea Muñoz-Patchen, CO₂ Pipeline Infrastructure for Sequestration Projects, 17 TEX. J. OF OIL, GAS, AND ENERGY L. 1, 23 (2022).

²⁸ WYO. STAT. ANN. § 35-11-316. Comparatively, either sua sponte or upon motion or application of an interested party, the WOGCC can establish a unit for oil and gas whenever required to protect correlative rights or prevent or assist in the prevention of waste. WYO. STAT. ANN. § 35-5-109. Forced pooling requires the consent of owners representing “at least eighty percent (80%) of the unit production or proceeds thereof that will be credited to royalty and overriding royalty interests which are free of costs,” WYO. STAT. ANN. § 35-5-110(f), although any “interested person” may apply to the WOGCC for this percentage to be lowered to 75%. Id.

²⁹ Tara Righetti, Jesse Richardson, Kris Koski & Sam Taylor, The Carbon Storage Future of Public Lands, 38 PACE ENV’T L. REV. 2, 191, 204 (2021). Unitization procedures for Class II well operations on federal lands are well established, however. “Injection of CO₂ or water for enhanced recovery [under Class II of the UIC] frequently requires unitization pursuant to federal law and harmonization with state law requirements for compulsory pooling and unitization.” Id. at 196.

State**Pore Space Unitization in Wyoming and its Neighboring States**

Colorado	Colorado has not addressed pore space unitization via legislation, but in its 2021 report, the COGCC recommends the Colorado Legislature refrain from adopting unitization provisions similar to those that were declared unconstitutional by the North Dakota Supreme Court. ³⁰ Colorado state law currently precludes COGCC from aggregating Colorado State Land Board property for pore space development.
Idaho	Idaho has not addressed pore space unitization.
Montana	In 2009, the Montana State Legislature passed a session law, S.B. No. 498, which includes numerous contingency provisions that become effective in the event Montana obtains primacy over its Class VI program. One such provision would authorize unitization for geologic carbon storage. ³¹
Nebraska	If a storage operator does not obtain the consent of all persons who own a reservoir estate within the storage reservoir, the Nebraska Oil and Gas Conservation Commission may require that any reservoir estates owned by non-consenting owners be included in a storage facility and subject to geologic storage. ³²
South Dakota	South Dakota has not addressed pore space unitization.
Utah	The State Board of Oil, Gas and Mining (Board) oversees and regulates geologic storage activities. The Board may enter an order combining all interests in the contiguous pore space for the development of a storage facility. An applicant for a permit for geologic storage must also demonstrate that it has made a good-faith effort to obtain the consent of all persons who own the storage reservoir's pore space and 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.
Wyoming	Wyoming statutes and regulations authorize the Wyoming Oil and Gas Conservation Commission to order unitization for geologic carbon storage if at least 80% of the affected pore space owners have consented. ³³

³⁰ See supra n. 15.³¹ MONT. CODE. ANN. § 77-3-430.³² NEB. REV. STAT. ANN. § 57-1612.³³ WYO. STAT. ANN. §§ 35-11-313 - 35-11-317; WYO. CODE R. § 55-3-43.

LONG-TERM STORAGE AND TRESPASS LIABILITY

Although the Class VI program subjects every storage project to strict modeling requirements and requires implementation of appropriate buffer zones, there remains a remote possibility of unintended migration resulting in subsurface plume or pressure trespass.³⁴ Liability concerns may be especially pronounced in relation to the migration of CO₂ plumes or pressure fronts to states that currently lack a defined CCS framework or subsurface trespass laws, as such states could, in theory, develop harsh trespass penalties or other laws adverse to the operator's interests in the future. Indeed, states that *have* considered the issue have enacted statutes along a wide and varying range of liability, creating a significant unknown for project proponents wishing to develop storage in relative proximity to states without established law.

In an attempt to delineate liability, some states have legislatively established a cause of action for subsurface trespass (e.g., Nebraska).³⁵ At least one state legislature has taken the opposite approach,

with North Dakota having enacted legislation which would have definitively ruled out subsurface pore space trespass as a cause of action under any circumstances.³⁶ The North Dakota Supreme Court has since declared this legislation unconstitutional.³⁷ Others, including Indiana, have demonstrated the potential for legislation at the opposite end of the liability spectrum, deeming that claims of subsurface trespass shall not be actionable against a storage operator conducting carbon storage in accordance with a valid UIC Class VI permit unless the claimant proves that injection or migration of carbon dioxide: (1) is injurious to health, indecent, offensive to the senses, or an obstruction to the free use of property so as essentially to interfere with the comfortable enjoyment of life or property; or (2) has caused direct physical injury to a person, an animal, or tangible property.³⁸ In the majority of states that have yet to legislatively address the potential for subsurface trespass by CCS-associated CO₂ migration, it is possible that purported litigants may extrapolate from the common law established in relation to other types of subsurface trespass claims to argue for or against the right to assert a cause of action for CCS-associated subsurface trespass.³⁹

³⁴ Charles C. Steincamp et. al., Regulation of Carbon Capture and Storage: An Analysis Through the Lens of the Wellington Project, 51 ENVTL. L. 1149, 1170 (2021).

³⁵ NEB. REV. STAT. ANN. § 57-1618. This statute imposes liability on the storage operator for any damage resulting from the storage of CO₂, including damage caused by CO₂ that escapes from the storage facility, for so long as the operator holds title to the CO₂.

³⁶ See N.D. CENT. CODE ANN. §§ 38-11.1-03; 47-31-09 (held unconstitutional by *Nw. Landowners Ass'n v. State*, 2022 ND 150, ¶ 26, 978 N.W.2d 679, 692 (2022)), as amended by the passage of N.D. S.B. 2344 (2019), provided that surface owners will not accrue claims for the unauthorized use of pore space, either by statute or by common law.

³⁷ In 2022, the North Dakota Supreme Court invalidated portions of S.B. 2344 as unconstitutional, finding the legislation "allows third-party oil and gas operators to physically invade a landowner's property by injecting substances into the landowner's pore space" and that "[a]llowing such usage takes away one of the most treasured property rights because it takes away landowners' right to exclude oil and gas operators from trespassing and disposing waste into their pore space." *Nw. Landowners Ass'n*, ¶ 26, 978 N.W.2d at 692. In a second lawsuit filed in May 2023, the Northwest Landowners Association also challenges the constitutionality of North Dakota's pore space amalgamation law, claiming it constitutes an unconstitutional taking of property rights. See *Nw. Landowners Ass'n v. State*, Bottineau County District Court, Northeast Judicial District of North Dakota, Case No. 05-2023-CV-00065.

³⁸ IND. CODE § 14-39-2-12.

³⁹ For a surface owner to recover monetary damages on a claim of subsurface trespass, the majority of courts require a showing of actual damages to the surface owner's property, including but not limited to damage to groundwater or an interference with the owner's existing use of the pore space. See Tara Righetti, *The Private Pore Space: Condemnation for Subsurface Ways of Necessity*, 16 WYO. L. REV. 77, 95 (2016).

In Wyoming, a storage operator can limit its long-term liability by applying for a certificate of completion with the state, which can issue no earlier than twenty (20) years from the date of the last injection.⁴⁰ Upon issuing the certificate of completion, title to and liability for the stored CO₂ transfers to the State. Montana, Nebraska, and Utah have each adopted similar provisions.

State	Long-Term Storage and Trespass Liability for CO₂ Storage in Wyoming and its Neighboring States
Colorado	Colorado has not addressed responsibility for long-term stewardship over geologic storage facilities.
Idaho	Idaho has not addressed responsibility for long-term stewardship over geologic storage facilities.
Montana	Until a certificate of project completion is issued and title to the stored CO ₂ and geologic storage reservoir is transferred to the State, the geologic storage operator is liable for the operation and management of the CO ₂ injection well, the geologic storage reservoir, and the injected or stored carbon dioxide. The effectiveness of these laws is contingent upon and will only take effect when Montana obtains primacy over Class VI injection wells. ⁴¹
Nebraska	The storage operator has title to the carbon dioxide injected into and stored in a storage reservoir and holds title until the Nebraska Oil and Gas Conservation Commission issues a certificate of project completion, at which time ownership of the sequestered carbon dioxide vests with the State. ⁴²
South Dakota	South Dakota has not legislatively addressed the long-term stewardship of geologic storage facilities.
Utah	Immediately after the State Board of Oil, Gas, and Mining issues a certificate of completion, liability with respect to the storage facility and the stored carbon dioxide transfers to the State. ⁴³
Wyoming	Storage operators maintain liability for injected carbon dioxide for so long as the operator holds title thereto. The injector of CO ₂ shall have title to and liability for any CO ₂ injected into and stored in the underground reservoir until a certificate of project completion is issued. All CO ₂ and other substances injected into any geologic storage site for the purposes of geologic storage shall be presumed to be owned by the injector. A certificate of project completion cannot issue until at least 20 years after CO ₂ injections end, but upon the issuance of such certificate, the state is deemed to accept title to and liability for the facility. ⁴⁴

⁴⁰ WYO. STAT. ANN. § 35-11-319.

⁴¹ MONT. CODE ANN. §§ 82-11-182 TO -183.

⁴² NEB. REV. STAT. ANN. § 57-1618.

⁴³ UTAH CODE ANN. § 40-11-16

⁴⁴ WYO. STAT. ANN. § 35-11-319.

ILLUSTRATION OF INTERSTATE CHALLENGES⁴⁵

For an operator seeking to develop pore space in Wyoming via CCS, what do the absence of regionally cohesive policies mean for CCS operations? By way of illustration, take the example of an operator seeking to store CO₂ in Wyoming's Green River or Denver-Julesburg Basin, which straddles the border between Wyoming and Colorado. Unlike Wyoming, Colorado has not addressed pore space ownership within a statutory framework, much less issue a permitting or unitization framework or designate a state agency to oversee storage operations. Without further development in Colorado law, the operator's options appear twofold: 1) the operator could modify the project for isolation within Wyoming, utilizing Wyoming's procedures for permitting and unitization; or 2) as an influential legal scholar has suggested,⁴⁶ the operator could attempt to negotiate leases with all possible owners of the affected Colorado pore space (including both the surface and mineral owners in a wide buffer zone), hedging its bets as Colorado law develops. Neither option is ideal. Indeed, the former may result in the inefficient use or waste of potential pore space, tying up potentially useable pore space along the border in Wyoming, as well as all pore space in Colorado. The latter, conversely, may be economically impractical, potentially contrary to Colorado law, and—in the absence of a unitization mechanism in Colorado—depends entirely upon

the operator acquiring consent from all potentially affected landowners. Both pathways leave the operator open to significant regulatory delays and uncertainties to the extent federal lands are involved.

Even assuming a project is isolated to Wyoming, as in the first hypothetical above, how might an operator navigate the potential for fluid or pressure from a Wyoming storage complex to migrate toward Colorado pore space? In addition to obtaining a Class VI permit from the WDEQ, identifying and leasing the appropriate surface owners, and obtaining the requisite threshold of consent from affected pore space owners for a unitization order, the storage operator and/or WDEQ may be required to notify an appropriate Colorado agency and the EPA if the area of review encompasses any land located in Colorado.⁴⁷ However, there is little clarity around the operator's obligation, if any, to drill and maintain monitoring wells within the borders of Colorado, and what liability the operator could incur if trespass occurs. To the extent a project poses even a remote possibility of interstate migration, the operator's potential scope of liability is entirely uncharted. It is further unclear whether, or how, a geologic storage project spanning multiple jurisdictions would comport with state programs allowing storage operators to transfer long-term storage liability to the state.⁴⁸

⁴⁵ This section has been adapted from Madeleine J. Lewis, *The Space Between Us: Transboundary Challenges of Geologic Carbon Storage in Interstate and Federal Pore Space*, OIL, GAS & ENERGY LAW 3 (2023).

⁴⁶ Professor Owen Anderson has suggested that, in this situation, an operator may consider obtaining "sufficient subsurface rights to the property covering the total area under which the injected carbon oxide will migrate." Owen Anderson, *Legal and Commercial Models for Pore-Space Access and Use for Geologic Sequestration of CO₂*, 2015 NO. 4 RMLF-INST PAPER NO. 9 (2015). In many cases, according to Anderson, "this [acquisition] will prompt project participants to site a storage project in an area where the majority of the surface and mineral rights are controlled by a limited number of parties so that it simplifies the process of securing sufficient real property rights and related protections covering the entire expected plume and migration radius of injected substances." *Id.* Moreover, as Anderson noted, "acquiring a buffer area beyond the expected plume and migration radius is advisable to minimize the risk profile of any storage project in the event of unexpected migration." *Id.*

⁴⁷ See 40 C.F.R. § 146.82 (requiring state UIC program directors to "notify, in writing, any States, Tribes, or Territories within the area of review of the Class VI project").

⁴⁸ WYO. STAT. ANN. § 35-11-319.

REGULATORY CONSIDERATIONS RELATED TO FEDERAL PORE SPACE



Given the high concentration of federal lands located in Wyoming, large-scale CCS projects are almost certain to implicate these holdings, generating questions about the approach federal land agencies, such as the BLM, have taken toward CCS and what it means for access to pore space.

PORE SPACE OWNERSHIP

Current federal law fails to provide a legal definition of pore space, much less clarify the ownership of pore space in estates owned in less than fee simple (aka, in split estates, where the surface rights are privately owned, but the mineral rights are federally owned). There is particular uncertainty surrounding the ownership of pore space under approximately 70-million acres of lands in the United States patented under the Stock Raising & Homestead Act of 1916, which granted land to settlers for the grazing and farming of livestock.⁴⁹ Such patents expressly reserved “all coal and other minerals” to the United States. In the 1983 case of *Watt v. Western Nuclear Corp.*, the United States Supreme Court interpreted this reservation broadly to include every “subsurface resource.”⁵⁰ Legal scholars are divided on whether *Watt* would apply to determine the ownership of federal pore space,⁵¹ leaving the issue ripe for litigation. The risks associated with developing a project without a clear understanding of ownership will greatly impact the permitting of projects in places like Wyoming’s Powder River Basin, where a relatively large percentage of lands are split estates and are interspersed with state and private lands.

⁴⁹ Kevin Doran and Angela M. Cifor, Does the Federal Government Own the Pore Space Under Private Lands in the West? Implications of the Stock-Raising Homestead Act of 1916 for Geologic Storage of Carbon Dioxide, 42 LEWIS & CLARK ENV’T L. REV. 527, 531 (2012); Righetti, et al., supra note 28, at 194.

⁵⁰ *Watt v. W. Nuclear, Inc.*, 462 U.S. 36, 47 (1983) (“While Congress expected that homesteaders would use the surface of SRHA lands for stock-raising and raising crops, it sought to ensure that valuable subsurface resources would remain subject to disposition by the United States, under the general mining laws or otherwise, to persons interested in exploiting them. It did not wish to entrust the development of subsurface resources to ranchers and farmers.”).

⁵¹ See Righetti, et al., supra note 48, at 194 (providing overview of perspectives, comparing e.g., Doran and Cifor, supra note 48, and Owen L. Anderson, Geologic CO₂ Sequestration: Who Owns the Pore Space, 9 WYO. L. REV. 97 (2009)).

PERMITTING CHALLENGES & UNCERTAINTIES

Federal statutes generally regulate how federal lands are used, for what purpose, and by what agency, but none are specifically related to using federal pore space for geologic carbon storage. Without tailored guidance, permitting CCS projects in federal pore space will likely require applicants to navigate a checkerboard of different government agencies, each with diverse challenges and requirements. United States Forest Service (USFS) lands, for instance, are mandated to be managed for multiple use and sustained yield. Their management is regulated by the National Forest Management Act (NFMA), as well as other federal statutes. But these statutes do not specifically address how carbon dioxide storage fits under this mandate or how permitting would be done. Though there is a possibility for geologic storage to be considered as a potential use when the Department of Agriculture undertakes its “Renewable Resource Assessment” (which is required to be completed every ten years), geologic storage has not yet been considered and there remains considerable uncertainty related to managing and authorizing the use of federal pore space.

Complementing NFMA’s mandate to the USFS, the Federal Land Policy and Management Act (FLPMA) similarly stipulates that the BLM should manage its lands in conformity with nebulous principles such as multiple use, sustained yield, and preservation, which are implemented under a series of Resource Management Plans (RMPs) that serve as management blueprints. Most BLM regulations and RMPs do not specifically address CCS. However, on June 8, 2022, BLM released new guidance that begins to decrypt the process for CCS project developers to apply for a permit on BLM-administered lands. Instruction Memorandum (“IM”) 2022-041 IM 2022-041 authorizes BLM to issue rights-of-way (ROW) under Title V of FLPMA, which is the same ROW authority BLM uses to manage roads, transmission lines, telecommunications sites, and other surface uses. The IM clarifies that BLM’s authority under Title V includes authority to issue ROWs for the storage⁵² of carbon dioxide in federal pore space, including ROWs of a term for the construction and maintenance of necessary physical infrastructure, as well as use of the pore space itself.⁵³

⁵² Although this report generally uses the term “storage”, the IM uses the term “sequestration.”

⁵³ US DOI BLM IM 2022-041.



Other requirements and parameters set forth by IM 2022-041 include that:

Project applicants must comply with all applicable laws, including obtaining the appropriate Class VI permits;

Applicants must submit a Plan of Development as part of their application;

BLM must comply with FLPMA and all other applicable laws, including, for example, the National Environmental Policy Act, the Safe Drinking Water Act and the Mineral Leasing Act;

If approved, and unless a shorter period is requested by the applicant, ROWs will be issued for minimum 30-year renewable term unless the applicant requests a shorter term; and

In addition to charging for occupancy for injection facilities and similar surface uses, BLM contemplates charging injection fees for carbon dioxide and for occupancy of federal pore space on a “per unit basis” (which is not defined in the IM).



IM 2022-041 offers some guidance, yet many more questions regarding the development of CCS on federal lands remain unanswered. For instance, it remains unclear how carbon dioxide storage would fit into BLM’s multiple-use mandate (for instance, whether carbon dioxide storage would be subordinate to surface and/or mineral activities). The IM is also unclear on the extent to which proposed storage projects will require the BLM to amend existing Resource Management Plans (RMPs). The IM instructs that “[p]roposed storage projects must be in conformance with the appropriate land and realty allocations within applicable Resource Management Plans” and suggests “[p]ublic lands open for ROWs may not require an RMP amendment, although the terms and conditions of each RMP should be reviewed for conformance.”⁵⁴ As none of the RMPs overlying Wyoming currently address geologic storage, projects may need to be reviewed pursuant to the applicable RMP(s) on a case-by-case basis to determine the necessity of an amendment.⁵⁵ To the extent any amendments are required, the NEPA process is likely to be triggered, resulting in time-consuming and costly reviews. For instance, in 2020, CEQ reported that the average EIS completion time is 4.5 years.⁵⁶ Given 45Q’s current beginning of construction deadline of January 1, 2033,⁵⁷ lengthy EIS reviews may narrow the window for CCS operators to establish projects in Wyoming, forcing them to consider siting in states with less federal land ownership.

⁵⁴ U.S. DOI BLM IM 2022-041.

⁵⁵ Righetti et al., *supra* note 28, at 199.

⁵⁶ COUNCIL ON ENV’T QUALITY, EXEC. OFF. OF THE PRESIDENT, ENVIRONMENTAL IMPACT STATEMENT TIMELINES (2010-2018) (2020) https://ceq.doe.gov/docs/nepa-practice/CEQ_EIS_Timeline_Report_2020-6-12.pdf [<https://perma.cc/Q3QU-EJ3J>].

⁵⁷ 26 U.S. CODE § 45Q(d).



Further, issues of pore space ownership are not entirely resolved under the IM. While the IM does acknowledge that pore space is vested with the surface owner in most instances, the BLM does not indicate whether it would also adopt such a position. According to the new guidance, questions about pore-space ownership are to be resolved in coordination with the BLM’s Solicitor’s Office.⁵⁸ The BLM also recommends that applicants should conduct a title review to determine pore space ownership, but even then, it may be an unsettled issue of law as to whether pore space was meant to be included in a certain conveyance or patent.

Other issues on which IM 2022-041 is silent or unclear include (but aren’t limited to):

Whether BLM could enforce subsurface trespass claims if it did claim ownership of split-estate pore space, and whether “subsurface trespass” would include plume trespass, pressure trespass,⁵⁹ or both;

Procedures, if any, for unitization of federal pore space, or guidance as to whether state unitization procedures would instead apply;

The scope of any required NEPA review;

How BLM intends to define a “per unit basis” in reference to injection fees and occupancy;

Whether surface ROW exclusions contained in BLM land management plans will apply to constrain pore space ROWs; and

The interaction of BLM permitting with Wyoming’s Class VI Program.

⁵⁸ U.S. DOI BLM IM 2022-041.

⁵⁹ Pressure trespass is a temporary form of trespass that will only impact the resource during and shortly after injection operations.



CONCLUSIONS AND RECOMMENDATIONS

For Wyoming to utilize the full potential of its pore space for CCS, there is a pressing need to reduce policy gaps on a regional scale through coordinated action that extends to federal land agencies, tribal governments, and policymakers of neighboring states. Indeed, the majority of basins with high CO₂ storage potential have large footprints transcending the boundaries of at least two states and almost all traverse federal land holdings, leading to questions about how—and whether—this interstate pore space can be effectively permitted for CCS projects.

Reducing policy gaps will require Wyoming’s neighboring states to adopt statutes and regulations that coordinate, clarify, and resolve issues such as pore space ownership, unitization, and liability for any unintended CO₂ plume or pressure front migration. While policy around the oil and gas industry may offer several instructive corollaries for the efficient and waste-reductive development of pore space from a regional approach, there are fundamental differences which render the governance of pore space virtually unprecedented.

Given the high concentration of CCS-viable pore space in federal lands, there is also need for federal agencies with significant pore space holdings, such as the BLM, to articulate a cohesive geologic storage framework (including RMP amendments necessary to authorize geologic storage); adopt a definition of pore space that clarifies the extent to which the agency claims an interest in the pore space under federal lands; clarify the federal pore space leasing process through rulemaking; and implement clear strategies for federal policy to interface with state geologic storage frameworks. For instance, it remains unclear whether state unitization frameworks could be leveraged to consolidate federal interests in a storage facility,⁶⁰ or the extent to which state processes for site closure and liability transfer would apply to projects involving federal pore space.

⁶⁰ Righetti, et al., *supra* n. 28 at 198–99.



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