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Aggregating Pore Space Ownership for Geologic Sequestration of CO_2

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Aggregating Pore Space Ownership for Geologic Sequestration of CO_2

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Abstract

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The injection operator for a carbon dioxide sequestration project must control the reservoir and associated pore space within the project boundaries to allow for orderly development of the storage facility. A large number of interest owners within a project area is likely to make reaching unanimous agreement among all owners of pore space unlikely, and thus control of the reservoir difficult. In order to facilitate geologic sequestration of carbon dioxide on privately owned land in the United States, or on land for which the minerals or pore space are privately owned, a scheme for aggregating the ownership of pore space is needed. To allow geologic sequestration projects to move forward with less than unanimous consent of interest owners, states can employ various methods of aggregating pore space ownership. This paper examines oil and gas unitization statues and statutes creating groundwater districts to find legislative regimes useful for achieving pore space ownership aggregation. Among the approaches discussed, aggregation of pore space ownership through a unitization model is the most likely choice. Taking that one step further and setting up new unit operating agreements for enhanced oil recovery to serve as a repository for incremental geologic sequestration, and

eventual full sequestration activities, provides a firm path toward reducing carbon dioxide emissions while respecting property rights. This paper also compares the few existing pore space aggregation statutes in the United States, which achieve aggregation of pore space ownership through either unitization or eminent domain. The state that appears to be the best equipped to deal with aggregation of pore space ownership is Wyoming. Wyoming has been a leader in developing legislation to deal with pore space ownership before other states. North Dakota and Utah are also very well situated to move forward with carbon sequestration activities.

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Introduction

Carbon capture and storage has three components: capture, transportation, and storage. The Energy Information Administration (EIA) defines capture as “the physical removal of carbon dioxide that would otherwise be emitted into the atmosphere.” Transportation is defined as the means of moving carbon dioxide from the source to sites suitable for storage. The storage required, according to EIA, is long-term, permanent sequestration “to prevent captured emissions from entering the atmosphere.” The ability of a storage site to house large amounts of injection carbon dioxide varies, and is dependent upon the formation’s depth, thickness, and permeability. EIA sees deep saline aquifers and depleted oil and gas fields as the most likely candidates for storage (“International Energy Outlook”).

Research is underway by the National Energy Technology Lab (NETL) focusing on five kinds of geologic formations for geologic sequestration of carbon: depleted oil and gas reservoirs, deep saline formation, unmineable coal seams, oil and gas rich organic shales, and basalts. The first three are the primary focus of the research ("NETL: What is the status"). Varying amounts of potential storage within the United States and Canada have been identified within each kind of formation by researchers associated with the NETL work: for oil and gas reservoirs, 82.4 million metric tons of sequestration potential exists; for coal 156-183 billion metric tons; and for saline formations 3,300 billion metric tons ("NETL: What is the status").

No commercial project of the scale needed to sequester carbon dioxide from a coal-fired power plant is currently operational (“International Energy Outlook”). Technology that accomplishes this would also be applicable to carbon dioxide sources other than coal-fired power plants. Industrial emissions sources and natural gas-fired

power plants have potential need for carbon capture and storage under proposed carbon reduction actions.

NETL lists several benefits of carbon capture and sequestration: it would provide a solution for reducing green house gases while still allowing the use of fossil energy, it could be used to produce more fossil energy from certain sources—oil from oil and gas reservoirs and coal bed methane from coal seams—while also storing green house gases. NETL cites estimates that "the cumulative benefits to the [United States] from carbon capture and sequestration associated with enhanced resource recovery would total $170 billion by 2020 and $4 trillion by 2050" ("NETL: What are the costs").

Because geologic carbon sequestration projects require such a large volume of pore space, and thus a large aerial extent, many interest owners in pore space, surface access, and mineral estates must be sought to acquire the respective access rights. While only consent of the pore space owners is needed for the actual storage of the carbon dioxide, consent of the surface and mineral owners is often sought to cover other access needs and to ensure that the proper interests have been completely acquired or leased. Surface use will be required to install wells, maintain well installations, and for access to monitor project operations. Roads may have to be installed or modified. The surface owners may not be the same as the pore space owners.

It is important to note that geologic sequestration on state and federally owned land, where a government entity owns the mineral estate and the pore space, eliminates the pore space ownership issues discussed in this paper. This paper covers lands where surface, pore space, and/or mineral ownership are privately held.

Chapter 1, Review of Pore Space Ownership

The ownership of pore space has gained attention in recent years as the need to access it for storage has become apparent. Interpretations differ among authors as to who owns subsurface pore space. Ownership of pore space is attributed to either the surface or mineral owner, depending upon the commentator. The prevailing view, however, is that the ownership of pore space runs with the surface ownership.

In 2011, Endres released an article addressing pore space ownership allocation from an economic perspective. Through analysis of two projects in Illinois, Endres showed the issues encountered by two distinct approaches to a carbon sequestration project. First, starting injection operations before property rights to the pore space were secured. Second, securing an easement from surface owners before beginning injection operations (Endres 644). He notes significant differences in up-front costs between the two approaches—in both time and money spent. Securing the rights from surface owners prior to injection added significantly more time and money to the second approach listed above because the effort was entirely absent in the first approach (Endres 644). It is interesting to note that the state of Illinois does not have any legislation pertaining to ownership of pore space as related to carbon sequestration. To account for this uncertainty, the project that secured the easement ahead of injection paid a fixed fee per acre to obtain the easement, with additional payments dependent on revenue from sequestration operations (Endres 646). In that case, the minimum payment was approximately twenty dollars per acre of surface subject to the easement, or eight percent of the gross revenue from operations (Endres 646). Endres referenced the well-known economist Coase, specifically using an analogy to Coase's idea that "a price mechanism can, and should, allocate resources in an economically efficient manner without the need

for government oversight" (Endres 629). Endres goes on to quote Coase's commentary concerning radio frequencies,

> A private-enterprise system cannot function properly unless property rights are created in resources, and when this is done, someone wishing to use a resource has to pay the owner to obtain it. Chaos disappears; and so does the government except that a legal system to define property rights and to arbitrate disputes is, of course, necessary (Endres 629).

As Endres notes, Coase's commentary is applicable to the subject of carbon sequestration. Endres goes on to quote Coase multiple times, stressing that the use of property is ultimately decided by who can pay the most to use the property for their purpose, and stressing that the legal system established a delineation of rights (Endres 630). Drawing on these thoughts, Endres asserts,

> …development of the CCS industry (and the resulting socially beneficial impact of mitigating climate change) is independent of pore space ownership. If the value of the pore space for carbon sequestration results in the highest value use of the property, the market will allocate these pore space rights to the CCS industry through pricing mechanisms (Endres 630).

Endres continues, "simple placement of the initial property right in the surface estate fails to address many of the lingering questions regarding compensation and liability uncertainties. Nor does it necessarily eliminate transaction costs or information asymmetry" (Endres 639).

Duncan, Anderson, and Nicot studied pore space ownership under common law going back to 1861, and noted that the surface owner owns the pore space under that regime, while the mineral owner has the right to extract minerals. One exception to this rule was noted: when the fee simple owner sells the surface but reserves the subsurface rights (Duncan, Anderson, and Nicot 4427).

In light of the conflicting views of pore space ownership—torn between the surface and mineral estates—Owen Anderson has suggested, "permission from both the

surface owner and mineral owner is certainly the cautious approach. Nevertheless, [he] submit[s] that the most likely 'owner' of the pore space is the surface owner." Anderson's assertion is based on four ideas, as related to Texas law: (1) property rights not expressly conveyed are retained, and property rights not expressly reserved are conveyed; (2) when a fee-simple owner transfers the mineral estate or the surface estate with a reservation of the minerals, two severed estates are created; (3) the mineral estate is dominant over the surface estate; and (4) a regulatory agency does not have authority to determine property rights simply because it has the power to authorize regulated activities in the subsurface (Anderson 102).

To avoid the uncertainty surrounding pore space ownership, some states have enacted legislation that declares the surface owner as the pore space owner. This type of legislation will be discussed at greater length in Chapter 5.

Marston and Moore caution against treating geologic sequestration of carbon dioxide like the natural gas storage, asserting several differences between natural gas storage and geologic carbon sequestration operations:

> The incidental CO2 storage in EOR operations involves injecting an extraneous substance – CO2 – into the reservoir (whereas natural gas storage involves injecting only more natural gas into the reservoir). In addition, there will remain oil in the reservoir that belongs to the owners of the mineral interests. As explained below, these differences mean that the pore-space ownership of the surface owner should pertain only to actual available pore space (i.e. not occupied by residual oil) and that a large and significant portion of the pore space in an EOR project will in fact not be initially available at the end of an EOR project because of the presence of that residual oil, which may be potentially recoverable (Marston and Moore 475).

In the US, natural gas storage is federally regulated, under the Natural Gas Storage Act. The act allows for eminent domain to be used to obtain property rights for natural gas storage facilities. Under section 717(f) of the Natural Gas

Act, a holder of a certificate of public convenience and necessity (issued by Federal Energy Regulatory Commission) can use the power of eminent domain to acquire and construct underground storage facilities for natural gas. The Act reads,

> "(h) Right of eminent domain for construction of pipelines, etc. When any holder of a certificate of public convenience and necessity cannot acquire by contract, or is unable to agree with the owner of property to the compensation to be paid for, the necessary right-of-way to construct, operate, and maintain a pipe line or pipe lines for the transportation of natural gas, and the necessary land or other property, in addition to right-of-way, for the location of compressor stations, pressure apparatus, or other stations or equipment necessary to the proper operation of such pipe line or pipe lines, it may acquire the same by the exercise of the right of eminent domain in the district court of the United States for the district in which such property may be located, or in the State courts. The practice and procedure in any action or proceeding for that purpose in the district court of the United States shall conform as nearly as may be with the practice and procedure in similar action or proceeding in the courts of the State where the property is situated: Provided, That the United States district courts shall only have jurisdiction of cases when the amount claimed by the owner of the property to be condemned exceeds $ 3,000."

Note that storage facilities are not explicitly stated in the language of the act, but the phrase "construction of pipelines, etc." and reference to "other stations and equipment necessary to proper operation" leaves room for interpretation and inclusion of storage facilities. Case law has confirmed that storage facilities for carbon dioxide can be acquired by eminent domain when a certificate of public convenience and necessity is obtained from FERC.

The certificate of public convenience and necessity will be granted under the act "if it is found that the applicant is able and willing properly to do the acts and to perform the service proposed and to conform to the provisions of the Act [15 USCS §§ 717 et seq.] and the requirements, rules, and regulations of the Commission thereunder, and that the proposed service, sale, operation,

construction, extension, or acquisition, to the extent authorized by the certificate, is or will be required by the present or future public convenience and necessity" (717f(e)). It is also important to note that states have some jurisdiction over natural gas storage.

Chapter 2, The Need for Aggregation of Pore Space Ownership

The Interstate Oil and Gas Compact Commission concluded "as part of the initial licensing of a storage project the operator must control the reservoir and associated pore space to be used for CO2 storage in order to allow for orderly development and maximum utilization of the storage reservoir." (*CO2 Storage: A Legal*).

If one accepts this conclusion, the injection operator will need to acquire rights to use the pore space in order to carry out geologic sequestration. Regardless of exactly which estate owns that pore space, the right to access the pore space must be acquired, whether by lease, purchase, or easement, by the injection operator. A discussion of how the various estates in land relate to one another is presented below to provide further explanation of the need for aggregation of pore space ownership.

In a fee simple estate, the owner of a surface tract of land owns everything to the heavens above and everything to the center of the earth below that tract of land. This ownership can be thought of as a bundle of rights. The fee simple of owner has the right to use the surface and exploit the minerals, in addition to other rights. Just as the fee simple owner has the right to use all of those rights, he also has the right to transfer some of those rights to another individual. When those rights are transferred, they are severed from the surface estate. In effect, multiple estates are created. The initial fee simple owner would also have the ability to transfer only a portion of the rights while retaining a portion for himself. The new owner could then transfer all or a portion of their newly acquired rights in any estate. Over time, the various estates associated with any parcel of land can be split between multiple owners and the ownership of each estate can be fractionated. This splitting of interests often occurs when an interest owner dies, either

leaving a will specifying how his interests should be split or dying without a will and the interest being split amongst heirs by a court. Over time, the number of interest owners who may own an interest in the pore space in a single tract of land can multiply markedly. The injection operator will have to negotiate for consent to use the pore space with each of these owners for each individual tract of land within the project area. This is a time and money intensive process when one considers the actual process of determining the ownership through recorded property transactions, locating each interest owner, and reaching an agreement through negotiation.

Endres notes that "when the property right is uncertain and the transfer of these rights involves large numbers of individuals acting jointly, the process of negotiation may be so difficult and time-consuming that the market becomes too costly to operate as a means to achieve an economically efficient outcome" (Endres 638). This is a strong motivation for a state to go in the direction of eminent domain, or perhaps even along the path of water district regimes to avoid dealing with the numerous individual pore space owners and the time involved in such a process. The difficulty in dealing with multiple property owners might also deter some projects from being sited on private land, instead being sited on state or federally owned land. It also exemplifies the difficulty associated with dealing with each interest owner individually to reach unanimous consent to a storage project.

It is important to note that the right to use the pore must be obtained before any carbon dioxide can be injected. To address the intensive time, manpower, and money commitment, finding a way to aggregate that ownership would facilitate the timely implementation of carbon sequestration projects by shortening the up-front time commitments.

Two potentially problematic situations for injection operators include owners who cannot be located or reached to seek consent, and owners who refuse consent to the project. Without some way to aggregate the pore space ownership, even the smallest interest owner in the smallest tract within the desired project area could prevent a project with wide-reaching societal benefit, causing it to be stalled or even canceled.

Chapter 3, Competing Legal Approaches to Pore Space Ownership

Two basic approaches to gaining certainty in pore space ownership exist: development over time through the common law and by legislative action to assign and clarify pore space ownership.

A main problem with addressing uncertainties in pore space ownership over time through development of the common law is the length of time needed for that development. Development of a pore space ownership policy over time would require a kind of trial and error process for injection operators. The injection operators would try an approach and litigation would follow from an interested party. There is the strong possibility of the outcome to any initial legal proceeding being appealed, adding more time and expense to the process, as well as prolonging the uncertainty for project developers. Development of a policy over time could cause a problem regarding landowner holdouts. Without unitization, injection operators would not be able to force the landowners to participate. However, if a non-consenting landowner's tract is situated in the middle of a geologic sequestration project, the injection operator would have little ability to guarantee that the injection carbon dioxide would not reach the pore space owned by a non-consenting interest owner. Endres described this scenario in his review of a carbon sequestration project in Illinois:

> The common law situation in Illinois lacks a process for resolving potential windows in the pore space. Of course, one possible solution with respect to holdouts is to… [commence] sequestration operations with the possibility of ex-post litigation. On the other hand, in this two-party game, the holdout landowner faces a risk of zero compensation if a court declines to find an infringement of a property right. This uncertainty may propel a landowner to accept a lower price (Endres 646).

This excerpt points out that disadvantages exist for both the injection operator and the non-consenting interest owner when some interests are left out of the project.

Establishing legislation to assign the ownership of pore space, how ownership of pore space can be transferred, and whether or not it can be severed from other estates in land adds certainty for injection operators that cannot be immediately achieved through common law development of the issues. Legislation would allow for a clear statement of the property rights and how they are to be handled by parties involved in geologic sequestration activities. Generally speaking, the legislative process allows for participation by interested parties through contact with their legislative representative. Interest owners concerned about how the rights pertaining to the pore space under their land might be handled, as well as those with interests in sequestration projects, would be able to express their opinions to their designated representative, rather than the process being decided in consideration of the particular circumstances surrounding the pore space of a few specific persons involved in a court proceeding. Another advantage of legislation is that it can be written to encompass a multitude of anticipated situations prospectively and prescribe a process for dealing with unexpected situations by hearing or other process.

Chapter 4, Models for Aggregation of Pore Space

COMPULSORY UNITIZATION STATUTES FOR PETROLEUM EXPLORATION AS A MODEL

Unitization is used in oil and gas development to provide a single plan for developing an entire reservoir. Such a manner of development is advantageous because it avoids the problems that arise when multiple owners or multiple lessees make up their own plans of development. Competing interests in developing the same reservoir may be in contradiction with one another, or even contradictory to maximizing the ultimate recovery from the reservoir. The goals of compulsory unitization statutes are preventing waste, increasing ultimate recovery, optimizing well drilling, and protecting correlative rights.

Thirty-six states have compulsory unitization statutes in place, including: Alabama, Alaska, Arizona, Arkansas, California, Colorado, Florida, Georgia, Hawaii, Illinois, Indiana, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Montana, Nebraska, Nevada, New Mexico, New York, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Utah, Vermont, Virginia, Washington, West Virginia, and Wyoming. Table 1, Compulsory Unitization Statutes for Oil and Gas by State, shows the various components of each state's statute.

In a compulsory unitization scenario, an interested party petitions for creation of a unit. The parties who may petition vary from state to state but may include any of the working interest owners, royalty owners, carried interests, net profit interests, and those entitled to production payments. Once that petitioning occurs, the petitioner has a limited amount of time to obtain the consent of a threshold percentage of interest owners before the commission can approve the creation of a unit. Some states eliminate certain groups

from the consent tally. For instance, North Dakota excludes any interest that is carved out of the leasehold interest (N.D. Cent. Code § 38-08-09. Voluntary agreements for unit operation valid.). Nevada excludes from the count royalty interests that are owned by lessees or lessee's subsidiaries (Nevada Revised Statutes Annotated. 522.0834. Order for compulsory unitization: Consent of certain percentage of owners required; hearings; revocation of order). Still other states, including Oregon and South Carolina, specifically include overriding royalty interests and other leasehold interests. In some states, if one party holds a large portion of the working interest, the state may require that two or more parties consent to unitization.

The threshold percentage of consent required for compulsory unitization varies from state to state. A few state statutes do not specify the threshold percentage, including: Alaska, Hawaii, Indiana, Pennsylvania, and Virginia. On the low end of consent requirements, some statutes require consent from only slightly more than half of appropriate parties. States with this low threshold include Tennessee, Illinois, and Kentucky. Tennessee's compulsory unitization statute requires greater than 50% of pool producers (Tennessee Code Annotated. § 60-1-202. Powers of board). Kentucky requires consent from 51% of "interest owners" (Kentucky Revised Statutes § 353.645. Operation and development as a unit of oil and gas interests in a pool or pools -- Application for unit -- Hearing -- Unitization order). Illinois requires consent of 51% of interest and royalty owners. (Illinois Compiled Statutes Annotated. § 225 ILCS 725/23.8. [Approving plan of unitization]) On the high end, Colorado requires 80% consent from working interest, royalty, overriding royalty, and production payment owners (Colorado Revised Statutes. 34-60-118. Agreements for development and unit operations). The remaining states lie in between those listed above, but are clustered around 63% and 75% consent required for a compulsory unitization order to be issued.

Some states have lowered the threshold percentages that were included in their initial legislation. Alabama amended its compulsory unitization statute in 2009 to change the consent requirement from 75% to 66 2/3% (Code of Alabama § 9-17-84. Unit Operations). Montana amended its compulsory unitization statute to lower the consent percentage from 80% to 70% working interest and 60% royalty interest (Montana Code Annotated 82-11-207 Approval of plan for unit operations by persons paying costs). South Dakota was reduced from 75% of working and royalty interest owners to 60% of each. In a similar tone, Wyoming requires 80% consent as a general standard while the Commission can allow the threshold to be lowered to 75% under certain circumstances (Wyoming Statutes Annotated. § 30-5-110. Agreements for waterflooding or other recovery operations).

How Pore Space Aggregation Fits the Unitization Statute Model

Compulsory unitization statutes are good models for geologic sequestration of carbon for multiple reasons. The two efforts share motivations for systematic development, and could have the same problems with reaching 100% consent. Furthermore, because the regulatory framework for unitization is already familiar to stakeholders in many states where geologic sequestration could likely occur, aggregation of pore space ownership modeled after unitization could provide any easy transition.

The goal of unitization is to provide for uniform development of a reservoir. Sequestration of carbon requires a similar systematic approach. Placement of injection wells and placement of monitor wells both require a uniform pattern of development for storage.

Because geologic carbon sequestration projects require such a large volume of pore space, many pore space owners must be approached in an attempt to acquire or lease

the pore space rights. When the pore space is not severable from the surface estate, this will likely be a leasing process. It may be impossible, or at least improbable, to locate all of the interest owners, especially in consideration of the fractionated status of property rights in the US. Allowing a storage project to move forward while meeting a threshold value for consent would allow more projects to move forward, and to more forward in a shorter amount of time.

A pore space ownership aggregation statute modeled after the form of a unitization statute would present a familiar framework in oil-producing states. That familiarity would likely extend to state agencies, regulators, and even interest owners.

Because not all states, namely Texas, have compulsory unitization, an alternate model is needed. Marston and Moore have commented on the lack of compulsory unitization in Texas and its effect on oil and gas production:

> although unitization is widely used in Texas, it is voluntary, and must be achieved through negotiation, with the end result that leases not included in a unit plan must be administered independently and the production accounted for as if that portion of the reservoir were not in the unit. The drawback of the Texas regime is that if most of the reservoir is undergoing enhanced recovery operations, a non-participating independent owner may see some production benefit for which he made no investment, or may enhance the nonparticipating lease, thereby most likely than not leaving some otherwise recoverable oil and gas behind (resulting in non-optimal recovery of resources" (Marston and Moore 478).

From this, Marston and Moore draw a conclusion that the hindrance to the use of carbon dioxide enhanced oil recovery will also be unfavorable to the development of carbon dioxide storage in Texas, as compared to other oil and gas producing states that might receive money from industry to create storage for incremental CO2.

Marston and Moore suggest an approach unique to other commentators: to modify newly initiated oil and gas production unit agreements, whether voluntary or

compulsory, by adding clauses stating agreement of the working interest owners and mineral interests owners to the future potential use for CCS storage:

> This could be done by including in the Unit Agreement the extension of the oil and gas leases beyond termination of the Unit and through a future potential CO2 storage term, which term would be until the CO2 storage project itself were actually permanently terminated and sealed… It could also provide the mechanism whereby the mineral interest owner consents to his residual pore space being utilized for CO2 storage. (Marston and Moore).

Inclusion of surface owners in the early development of the unit for EOR would allow a smooth transition into carbon sequestration operations.

GROUNDWATER STATUTES AS A MODEL FOR PORE SPACE AGGREGATION

Because not all producing states favor the idea of compulsory unitization statutes, another model is needed. Some states devote a portion of their water code to regulating the use of water from aquifers. This can take the form of groundwater districts. Groundwater districts are generally formed around the extent of a groundwater aquifer and can cross civic subdivisions. Groundwater districts seek to prevent waste in the aquifer, to regulate well spacing, and to regulate production of water from the aquifer.

In Texas, voters encompassed by a proposed groundwater district must vote to approve the formation of the water district, as well as approve the management plan for the district (Texas Water Code. § 35.004. Designation of Groundwater Management Areas).

Another point related to groundwater that can be drawn upon in the discussion of pore space ownership was noted by Owen Anderson: that there are situations where the

surface owner retains rights to some subsurface substances after the minerals have been severed. Anderson describes *Sun Oil Co. v. Whitaker,* a Texas Supreme Court held that "the oil and gas lessee, acting under a lease from the fee-simple owner who subsequently conveyed the surface estate to Whitaker, had the right to use groundwater to the extent reasonably necessary to produce oil and gas. In other words, Sun's right to use groundwater implicitly recognized surface-owner title to the groundwater." While this does not speak directly to pore space ownership, or the right to use pore space, it does point to retaining some subsurface rights with the surface estate and may provide additional insight for groundwater law analogies for pore space ownership aggregation. (Anderson 1002).

Endres also compared storage of fresh water in natural aquifers, or underground water storage rights, to the permanent storage of carbon for sequestration, asserting: "a property rights rule based on the freshwater storage analogy, whereby the state retains ownership of aquifer pore space, could simplify otherwise disparate property law rules regarding ownership and compensation issues for CCS operations injecting into saline aquifers" (Endres 636). He makes this statement based on legal cases related to storage of water in subsurface through withdrawal and recharge, where public entities or permitted individuals inject water into the subsurface without compensating surface owners. The cited activities take place in Florida, California, and Colorado (Endres 636). Endres contrasts this water storage scheme against that of natural gas storage, where the injecting party may have the right of eminent domain, but must compensate the surface estate (Endres 636).

How Aggregation of Pore Space Ownership Fits the Groundwater District Model

The formation of groundwater districts is a good model for how pore space can be aggregated via statute because geologic sequestration projects cover large areas and cross political boundaries in the same manner as water district. The voting structure used to approve the water districts could be used to approve a district for the sequestration of carbon in pore space. Because the ideas of compulsory unitization is not favored in all states, an approach that involves voting (i.e. consent) by a group larger than the immediately affected interest holders might appeal to certain political climates.

HOW PROPOSED AND EXISTING PROJECTS HAVE HANDLED PORE SPACE

FutureGen Alliance (FGA), a non-profit private sector organization acting in support of the US Department of Energy's FutureGen 2.0 program, is in the process of evaluating proposals for specific siting of a carbon dioxide injection site in Illinois. The goal of FutureGen 2.0 is to develop "a regional CO2 storage site ("hub") that could accept CO2 from a variety of industrial sources for safe, permanent storage" ("Siting Information - Prospective"). The project guidance does not prescribe how offerors should approach pre space specifically, but it does specify that offerors must demonstrate "the ability to obtain all necessary property rights" for operation of the site. ("Siting Information - Prospective"). Offerors must "indicate the nature (whether to sell, lease, or donate) and terms (including proposed cost, if any) for the transfer of land title or leasehold rights to the FutureGen Alliance for the proposed surface site." Offerors are required to show that they can obtain the surface rights and the mineral rights bordering the injection formation, specifically the formations immediately above and below the storage formation. Mineral rights are being addressed at this early siting stage because the FGA is seeking a non-development covenant, defined as "an

agreement not to develop the mineral resources" for the mineral rights directly above, in, and below the proposed injection formations in order to prevent the disruption of the integrity of the injection formation and the primary seal." They are not seeking mineral rights in formations closer to the surface. To document the ability to obtain the rights, "a signed statement from affected mineral rights owners of their willingness to donate, sell, or agree not to exercise their mineral rights located immediately above, in, and below the proposed injection formations(s) will be sufficient. If a sale is contemplated, the general terms of such a sale such as price should be provided." Additionally, "signed statements from landowners indicating their willingness to grant access to their property for MVA activities, and any terms regarding such access, will be sufficient." Offerors must "provide a list of the owners of the proposed CO2 storage hub site and evident of that ownership" ("Siting Information - Frequently").

This particular project is designed to accept and store 1.3 million metric tons (MMT) of CO2 per year for at least thirty years. There is a possibility of expansion, equating to 39 MMT minimum capacity over the projected span of injection (5 page doc). Initial estimates were set at 1,000 acres for the plume area. "Prior work in the [formation] suggest that a 39 MMT CO2 plume would require approximately 1,000 acres of subsurface storage rights" ("Siting Information - Frequently").

Offerors must provide information documenting the owners of the surface lands overlying the plume area (FutureGen Industrial Alliance).

> Site offerors must be able to identify the owners (titleholders) and provide supporting documentation demonstrating ownership for (1) the subsurface area required for the anticipated 39 MMT CO2 plume (pore space) and (2) the subsurface water, mineral and other resource rights within, immediately adjacent

> to, and below the anticipated 39 MMT CO2 plume. The FGA must be able to obtain the subsurface rights for the pore space. In addition, the FGA must also be able to obtain a waiver of all subsurface water, mineral, and other resource rights within, immediately adjacent to, and below the anticipated 39 MMT CO2 plume or be able to obtain those rights. This is to ensure that natural gas, water, minerals, or other resources cannot be withdrawn from formations underlying the primary seal and anticipated CO2 plume" ("Siting Information - Prospective")

Another well known injection program is the Weyburn-Midale CO2 Monitoring and Storage Project that began in 2000. It studies injection and storage of CO2 in depleted oil fields, and the injection is employed as a means of enhanced recovery of oil in two fields in Saskatchewan, Canada. It is important to note that this project injects carbon dioxide as a means of producing oil and gas, and not for the sole purpose of sequestration (*Weyburn-Midale CO2 Project*). The carbon dioxide is captured in the United States and piped to Canada. The project covers 53,000 acres ("Weyburn-Midale Storage Project"). In ten years of operation, between 2000 and 2010, approximately 17 million tonnes of carbon dioxide were injected at the site ("Weyburn-Midale Storage Project"). In this project, the carbon dioxide is injected to the benefit of the mineral estate. In the US, this type of project would be authorized by the owners of the mineral estate because it is part of the efforts to extract oil and gas.

Chapter 5, Legislation for Pore Space Ownership Aggregation

EXISTING LEGISLATION ADDRESSING PORE SPACE

There are three categories of legislation that deal with pore space as related to geologic sequestration of carbon: statutes that assign ownership of pore space, statutes that aggregate ownership of pore space, and statues that regulate the storage of carbon more generally. As the following discussion will illustrate, Wyoming has been a leader in legislation relating to pore space. Wyoming legislation on the topic became effective in 2008.

Statutes that Assign Pore Space Ownership

Some states have enacted legislation that specifically delineates who owns pore space. These states include North Dakota, Utah, and Wyoming. Generally, these statutes cover five concerns: who owns the pore space, how conveyances affect the ownership, severability of the pore space rights, how pore space leasing is affected by severability, and the subordinate nature of the pore space estate to the mineral estate. The lack of liability of the pore space owner for any damage caused by the injected carbon is sometimes also covered within the realm of these statues. Table 2, Statutes that Assign Pore Space Ownership, contains a summary of these provisions for the states listed above. Note that Utah's statute assigning pore space was due to the legislature's rules review committee by January 1, 2011, but no text was available for analysis at the time of this publication.

A comparison of the statues from these three key states shows that these statutes define pore space as one would expect, focusing on terms like subsurface, space/cavity/void, and storage. Both North Dakota and Wyoming assign the ownership of

pore space to the surface owners of the overlying surface estate. Conveyances of title to the surface include a conveyance of the pore space in both states, but Wyoming allows a severance if the language of the conveyance explicitly excludes pore space from the conveyance. The two states differ on their approach to the severability of pore space from the surface estate. North Dakota prohibits severance of pore space from the surface estate. Wyoming allows the pore space to be severed, but the exclusion must be specifically stated in the conveyance of the surface. Both states maintain the dominance of the mineral estate over the pore space and Wyoming goes so far as to require that the pore space owner's right to use the surface estate must be explicitly stated in the instrument conveying the pore space. North Dakota's statute stresses that leasing is allowed and does not constitute a severance of the pore space.

Statutes that Aggregate Ownership of Pore Space

Aggregation By a Unitization Model

Seven states that have enacted or proposed aggregation of pore space are listed in Table 3, Statutes that Aggregate Pore Space Ownership. Of those, three states follow a unitization model for aggregation of pore space ownership.

In 2011, Mississippi passed the Mississippi Geologic Sequestration of Carbon Dioxide Act (Mississippi Code Annotated. 53-11-1. Mississippi Geologic Sequestration Act). This statue does not define pore space, but does define geologic sequestration and geologic sequestration facility. Mississippi's definition of geologic sequestration stresses that the containment of carbon dioxide be long-term and in a subsurface geologic formation. Mississippi's definition of a geologic sequestration facility includes the reservoir, all wells, underground and surface equipment, as well as other property. The statute allows for unitization for the purposes of geologic sequestration when approval by

a majority interest of surface interest on the basis of and in proportion to the surface acreage content of the unite area and if separately owned a majority interests of all rights of the subsurface reservoir, on the same basis. The Mississippi statute, unlike some earlier statues in other states, specifically provides for the conversion of existing enhanced oil recovery operations into geologic sequestration facilities.

North Dakota enacted the Carbon Dioxide Underground Storage Act, which took effect in 2009 (North Dakota Century Code. § 38-22-01. Carbon Dioxide Underground Storage Act). The statute defines the term geologic storage as including both short-term and permanent underground storage of carbon dioxide. The definition of storage facility includes the reservoir, underground equipment, and surface facilities and equipment, but excludes pipelines used for carbon dioxide transport. The North Dakota statute allows the commission to amalgamate property interests by requiring non-consenting owners to be included in a storage facility if a minimum of sixty percent of pore space owners consent to the storage facility.

Wyoming enacted legislation allowing for the unitization of pore space ownership in 2008 under its Water Quality laws (Wyoming Statutes Annotated. § 35-11-313. Carbon sequestration; permit requirements). Wyoming's definition of geologic sequestration mentions the injection of carbon dioxide while highlighting the intention to prevent its release into the atmosphere. It defines a "geologic sequestration site" as the underground formation where carbon dioxide will be stored and a "geologic sequestration facility" as the surface equipment used for transport, storage, and injection of carbon dioxide. The statute allows for the unitization of one or more parties of a geologic sequestration site and pooling of the interests in pore space within the unit area. To issue a unitization order, the consent of eighty percent of pore space storage capacity with the unit area must be shown. The application for unitization must include the method for

determining the pore space quantity allotted to each tract within the unit, as well as details of how the economic benefits from use of the pore space will be distributed between pore space owners. From the time of order approval by the Wyoming Oil and Gas Conservation Commission, the applicant has six months to show the eighty percent approval of pore space owners. The threshold percentage can be lowered to 75% if the applicant can show that diligent good faith negotiations took place for nine months or more, and show that the percentage of approval required can not be obtained. Unitization of geologic sequestration sites; hearings on application, order; modifications.). Any order issued by the Wyoming Oil and gas Conservation commission will be entered into the county clerk's land records for the affected counties (Wyoming Statutes Annotated. § 35-11-316. Unitization of geologic sequestration sites; hearings on application, order; modifications).

The notice requirements under the permit applications and hearing processes of the various states that unitize on a compulsory basis for geologic sequestration indicate the extreme importance placed on the consent of any potentially affected parties. While not directly part of the consent provisions for all of the statutes discussed in this paper, the extent of parties that require notification is certainly indicative of the importance of informing those potentially affected parties. Notice requirements when seeking a geologic sequestration permit are stringent. Wyoming requires "proof of notice to surface owners, mineral claimants, mineral owners, lessees and other owners of record of subsurface interests" for the project area. Notice must also be mailed to surface owners, mineral claimants, mineral owners, lessees, and other owners of record of subsurface interests within one mile of the boundary of the site. That notice requires, at a minimum, weekly newspaper publication of the permit application in each county of the proposed

operations for four consecutive weeks (Wyoming Statutes Annotated. § 35-11-313. Carbon sequestration; permit requirements).

Aggregation by Eminent Domain and Expropriation

Ballantine's Law Dictionary identifies *eminent domain* and *expropriation* as synonyms, defining them as "the power of the nation or a sovereign state to take, or to authorize the taking of, private property for a public use without the owner's consent, conditioned upon the payment of a just compensation."

In 2009, Louisiana enacted a statute that authorizes storage operators "to exercise the power of eminent domain and expropriate needed property to acquire surface and subsurface rights and property interests necessary or useful for the purpose of constructing, operating, or modifying a storage facility and the necessary infrastructure…" (Louisiana Revised Statute. § 30:1101. Louisiana Geologic Sequestration of Carbon Dioxide Act).

Eminent domain authorized under the above mentioned Louisiana statues is also governed by procedures of R.S. 19:2 (Louisiana Revised Statute. § 30:1108. Eminent domain, expropriation). R.S. 19:2 covers the general provision of expropriation. In subpart 12, the details on expropriation for carbon sequestration activities provide, "Any domestic or foreign corporation or any partnership composed of such corporations or wholly owned subsidiaries thereof engaged in the injection of carbon dioxide for the underground storage of carbon dioxide approved by the commissioner of conservation. Property located in Louisiana may be so expropriated for the underground storage of carbon dioxide in connection with such storage facility projects located in Louisiana, including but not limited to surface and subsurface rights, mineral rights, and other property interests necessary or useful for the purpose of constructing, operating, or

modifying a carbon dioxide facility. This Paragraph has no effect on nor does it grant expropriation of the mineral rights or other property rights associated with the approvals required for injection of carbon dioxide into enhanced recovery projects approved by the commissioner under R.S. 30:4" (Louisiana Revised Statute. § 19:2. Expropriation by state or certain corporations and limited liability companies). The reference to R.S. 30.4, at the end of the previous statute quotation, points to the commission's power to regulate enhanced recovery operations (Louisiana Revised Statute. § 30:4. Jurisdiction, duties, and powers of the assistant secretary; rules and regulations).

In strong contrast to Louisiana's efforts, some states explicitly mention that sequestration projects cannot employ eminent domain. Oklahoma's statute states, "Nothing in this act shall grant a private operator the right of condemnation or eminent domain for any purpose" (27 A Oklahoma Statute. § 3-5-106. Construction of act, Oklahoma Carbon Capture and Geologic Sequestration Act). Wyoming's statute states, "No provision of W.S. 35-11-314 through 35-11-317 shall be construed to confer on any person the right of eminent domain and no order for unitization issued under this section shall act so as to grant to any person the right of eminent domain" (Wyoming Statutes Annotated. § 35-11-316. Unitization of geologic sequestration sites; hearings on application, order; modifications).

It is interesting to note that even if eminent domain is invoked, the owner of the pore space would still need to be identified in order to compensate the owner and a substantial time commitment to identifying and locating interest owners would not be avoided.

Statutes that Regulate the Storage of Carbon

Some statutes regulate the storage of carbon while also addressing ownership and aggregation of pore space, as discussed above. Other statutes address regulations of injecting carbon without speaking to the pore space issues. Texas SB 1387, passed in 2009, added language to the Texas Water Code to address injection of carbon for sequestration. Authority for this regulation was given to the Texas Railroad Commission. That particular statute does not address pore space ownership in any way. In a report filed in December 2010, in response to a request in the bill, authors recommended a regulatory framework that would speak to pore space ownership issues and go beyond protecting water safety in its scope (Texas Water Code. § 27.002. Definitions).

Conclusions

Development and deployment of a mechanism for aggregating pore space ownership in all states with geologic sequestration potential is imperative for carbon sequestration projects to move forward. Implementing such a system would reduce the difficulties encountered when an interest owner cannot be located or when a few interest owners hold out. For these project to operate efficiently, all pore space in the reservoir needs to be under the control of the injection operator so that orderly development and storage can take place. Allowing for the aggregations of pore space ownership is allowing geologic sequestration projects a chance to take hold and to significantly reduce the amount of carbon dioxide that would otherwise be emitted into the atmosphere.

Without aggregation of pore space ownership, the smallest interests owner in the smallest tract within a desired project area could prevent a project with wide-reaching societal benefit. Establishing legislation to assign the ownership of pore space, how ownership of pore space can be transferred, and whether or not it can be severed from other estates in land adds certainty for injection operators that cannot be immediately achieved through common law development of the issues.

Safeguards for interest owners subject to a possible geologic sequestration project included requiring consent of more than one interest owner when a large percentage of the project area is owned by one party, as well as excluding interest owners by injection operators or their subsidiaries from any tabulation for meeting a threshold percentage consent of pore space owners.

To facilitate the transition from enhanced oil recovery efforts to pure geologic sequestration efforts, including an extension of the unit agreement for oil and gas

production that involves surface and pore space owners at an early stage will ensure a majority of interest owners are on board with the project from an early point.

Aggregation of pore space ownership through a unitization model seems to be the most likely choice, as it has already taken hold in two states. Taking that one step further and setting up new unit operating agreements for enhanced oil recovery to serve as a repository for incremental geologic sequestration, and eventual full sequestration activities, provides a firm path toward reducing carbon dioxide emissions while respecting property rights.

The state that appears to be the best equipped to deal with aggregation of pore space is Wyoming. Wyoming has been a leader in developing legislation to deal with pore space ownership before other states. North Dakota and Utah are also very well situated to move forward with carbon sequestration activities because they have enacted legislation that clarifies ownership of the pore space.

Table 1. Compulsory Unitization Statutes for Oil and Gas by State

State	Compulsory Unitization Statute Code	Threshold Consent for Compulsory Unitization	Consent Clause	Notes
Alabama	9-17-80 to -88	66 2/3 % interest of working and royalty owners	9-17-84	Amended in 2000 and changed the consent from 75% to 66 2/3%
Alaska	31.05.110	All proper parties must be invited to join the unit, must make good faith effort for non-consenters	N/A	N/A
Arizona	27-531 to -539	63% of unit acreage by lessees and 63% of the 1/8 royalty	27-533	N/A
Arkansas	15-72-301 to -324, -501, -1001	75% undivided interest in right to drill, royalty, and overriding royalty	15-72-309	N/A
California	3320, 3640 to 3659 (Oil and Gas Subsidence Act)	Working interest owners who are entitled to 65% of proceeds of production prior to payment of royalties	3322.1	N/A
Colorado	34-60-116 to -122	80% those required to pay costs of operations (working interest owners) and owners of 80% of production/proceeds free of cost (royalty owners, overriding royalty owners, production payments)	34-60-118	N/A
Florida	377.27 to .29	75% interest in costs under the order and 75% in interest as production for royalty owners	377.28	N/A
Georgia	12-4-45	75% interest in costs under the order and 75% in interest as production for royalty owners	12-4-45	N/A
Hawaii	182-9.5	Not specified	N/A	N/A
Illinois	225 III. Comp. Stat. 725/23.1 to /23.16	51% working interest and royalty owners	225 ILCS 725/23.8	N/A
Indiana	14-37-9-1	Not specified	14-37-9-1	N/A
Kansas	55-1301 to -1315	63% working and royalty interests when production is at low economic level and needs artificial energy; or 63% working interests and 75% royalty interests when unitized management is reasonably necessary to prevent waste & increase recovery of O/G	55-1305	N/A
Kentucky	353.645 to .650	51% of interest owners	353.645	N/A
Louisiana	30: 5	3/4 owners and royalty interest owners	30: 5	N/A

Michigan	324.61701 to .61724	75% working and royalty interests, or 75% of all person entitled to production costs if 50% are free of costs, or 90% or persons entitled to production or proceeds of production	324.61706	N/A
Mississippi	53-3-101 to -119	75% owners or lessees based on and in proportion to surface acreage, or 75% of royalty owners based on and in proportion to surface acreage.	53-3-107	N/A
Missouri	259.120 to .130	75% working and royalty interest owners	259.120	N/A
Montana	82-11-201 to -216	70% of working interest, and 60% royalty interests; Requires approval of at least 2 parties on either term if one party owns more than threshold percentage, but less than 100%	82-11-207	Lowered from 80% of both working and royalty interest owners.
Nebraska	57-910 to -910.12	75% working and royalty interest owners	57-910.03	N/A
Nevada	522.0828 to .0878	62.5% working and royalty interest owners	522.0834	Excludes royalty interests owned by lessees or by subsidiaries of any lessee in consent threshold
New Mexico	70-7-1 to -21	75% working and royalty interest owners	70-7-8	If 75% or more working interest is owned by one party, must have two parties consent
New York	23-0101	60% working and royalty interest owners	23-0901	N/A
North Dakota	38-08-09	60% working and royalty interest owners	38-08-09.5	Excludes interests carved out of the leasehold interest; Requires more than one working and/or royalty owner
Ohio	1509.28 to .29	65% working and royalty interest owners	1509.28	N/A
Oklahoma	287.1 to .15	63% of working and royalty interest owners	287.5	Excludes royalty interests owned by lessees or their subsidiaries
Oregon	520.220, .230, .260 to .330	75% working and royalty interest owners	520.29	N/A
Pennsylvania	58 PA Cons Stat 408	Not specified	58 P.S. § 408 (2010)	N/A
South Carolina	48-43-350 to -360	75% working and royalty interest owners	48-43-350	N/A
South Dakota	45-9-37 to -52	60% working and royalty interest owners	45-9-40	Reduced from 75% required consent
Tennessee	60-1-202	Greater than 50% pool producers	60-1-202	N/A
Utah	40-6-7 to -8	70% working and royalty interest owners	40-6-8	N/A
Vermont	Title 29, 522, 525	60%	525	N/A
Virginia	45.1-301 & -302	Not specified	N/A	N/A

Washington	78.52.330 to .335	75% working and royalty interest owners	78.52.335	N/A
West Virginia	22C-9-8 to -9	3/4 owners and royalty interest owners	22C-9-8	N/A
Wyoming	30-5-109 to -110	80% working and royalty interest owners	30-5-110	May be reduced to 75% by commission in certain circumstances

Table 2. Statutes Assigning Pore Space Ownership

State	Identifying Info	Title	Definition of Pore Space	Title to Pore Space	Conveyances	Severability	Leasing	Effective Date	Dominance	Other Notes	Liability
North Dakota	N.D. Cent. Code, §47-31-01 to -08 (2011)	CHAPTER 47-31 Subsurface Pore Space Policy	"cavity or void, whether natural or artificially created, in a subsurface sedimentary stratum" (47-31-02)	with owner of the overlying surface estate (47-31-03)	Conveying title to surface of real property conveys pore space (47-31-04)	Title to pore space can not be severed from title to overlying surface area (47-31-05)	Leasing pore space is allowed and does not equate to severance (47-31-06)	April 9, 2009 (47-31-07)	Mineral estate dominant over pore space estate, as per common law (47-31-08)	N/A	N/A
Utah	54-17-701	Title 54. Public Utilities, Chapter 17 Energy Resource Procurement Act, Part 7. Carbon Sequestration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	States that recommended rules will be submitted to the UT legislature's rules review committee by January 1, 2011 in connection with carbon capture and sequestration for "(g) issues concerning ownership of subsurface rights and pore space"	N/A
Wyoming	Wyo. Stat. § 34-1-152	Title 34 Property, Conveyances and Security Transactions; Chapter 1 General Provisions; Article 1. In General; § 34-1-152. Ownership of pore space underlying surfaces	"subsurface space which can be used as storage space for carbon dioxide or other substances"	Ownership vests in surface owners above strata	Conveyance of real property includes conveyance of pore space below it in all strata unless previously severed or explicitly excluded from the conveyance	Allowed, but if a surface description is used in any conveyance, the transfer shall be deemed to include pore space at all depths underlying the described surface area unless specifically excluded	N/A	July 1, 2008	Pore space owner's right to use the surface estate must be explicitly stated in the instrument	"Transfers of pore space rights made after July 1, 2008 are null and void at the option of the owner of the surface estate if the transfer instrument does not contain a specific description of the location of the pore space being transferred. The description may include but is not limited to a subsurface geologic or seismic survey or a metes and bounds description of the surface lying over the transferred pore space."	Pore space owner, or the party above holding right to control pore space, is not liable for effects of injecting CO2 or other incidental substances (34-1-153)

Table 3. Statutes that Aggregate Pore Space Ownership

State	Identifying Info	Title	Definition of Pore Space	Definition of Sequestration/Storage	Definition of Storage Facility	What it Does	Requirements	Effective Date	Other Notes
Kentucky	HB 259							Proposed	
Louisiana	La. R.S. 30:1101-1111	Louisiana Geologic Sequestration of Carbon Dioxide Act	" 'Reservoir' means that portion of any underground geologic stratum, formation, aquifer, or cavity or void, whether natural or artificially created, including oil and gas reservoirs, salt domes or other saline formations, and coal and coalbed methane seams, suitable for or capable of being made suitable for the injection and storage of carbon dioxide therein." (30:1103)		" 'Storage facility' means the underground reservoir, carbon dioxide injection wells, monitoring wells, underground equipment, and surface buildings and equipment utilized in the storage operation, including pipelines owned or operated by the storage operator used to transport the carbon dioxide from one or more capture facilities or sources to the storage and injection site. The underground reservoir component of the storage facility includes any necessary and reasonable aerial buffer and subsurface monitoring zones designated by the commissioner for the purpose of ensuring the safe and efficient operation of the storage facility for the storage of carbon dioxide and shall be chosen to protect against pollution, and escape or migration of carbon dioxide." (30:1103)	Allows eminent domain and expropriation by storage operators for geologic storage facilities	Must obtain a permit and certificate of public convenience and necessity from the commissioner to exercise this power of eminent domain and expropriate to acquire surface and subsurface rights and property interests	August 15, 2009	
Mississippi	53-11-1 to -33	Mississippi Geologic Sequestration of Carbon Dioxide Act	Does not define pore space.	"Geologic sequestration means the long-term containment of a gaseous, liquid, or supercritical carbon dioxide stream in subsurface geologic formations. For purposes of this chapter, "storage" and "sequestration" have the same meaning. This term does not apply to carbon dioxide capture or transport."	"Geologic sequestration facility" means a facility that receives and contains or sequesters carbon dioxide, or has done so, including: (i) The reservoir into which carbon dioxide is injected; (ii) Sequestration wells, monitoring wells, underground equipment, and surface buildings and equipment utilized in geologic sequestration, owned by or under the control of the storage operator; and (iii) Other property identified by the board or the commission, as applicable, as part of the facility. The reservoir component of the geologic sequestration facility includes any necessary and reasonable buffer and subsurface monitoring zones designated by the board for the purpose of ensuring the safe and efficient operation of the geologic sequestration facility for the containment or sequestration of carbon dioxide and shall be chosen to protect against escape or migration of carbon dioxide. Nothing in this definition shall prevent orderly withdrawal of the contained carbon dioxide as appropriate or necessary to allow carbon dioxide to be available for enhanced oil or gas recovery projects or other authorized commercial, and industrial uses.	Allows for formation of a unit for geologic sequestration of CO2.	Approval by a majority interest of the surface interest on the basis of and in proportion to the surface acreage content of the unit area AND if separately owned a majority interest of all rights of the subsurface reservoir, on the eh basis of and in proportion to the surface acreage content of the unit area	April 2011	Approves conversion of an existing enhanced oil or gas recovery operation into a geologic sequestration facility and continuing of the authority and prior approvals of the board regarding unit operations
North Dakota	N.D. Cent. Code, § 38-22-01 to -23 (2011)	Carbon Dioxide Underground Storage	"a cavity or void, whether natural or artificially created, in a subsurface sedimentary stratum" (38-22-02)	"Geologic storage" means the permanent or short-term underground storage of carbon dioxide in a storage reservoir.	"Storage facility" means the reservoir, underground equipment, and surface facilities and equipment used or proposed to be used in a geologic storage operation. It does not include pipelines used to transport carbon dioxide to the storage facility.	"Amalgamating property interests," Commission can require nonconsenting owners to be included in storage facility (38-22-10)	must have 60% consent of pore space owners, must equitably compensate non-consenting owners (38-22-08) Must notify surface owners, pore space owners, mineral lessees, mineral owners, official county newspaper publication of hearing (38-22-06)	July 1, 2009	

Utah	Utah Code Ann. § 54-17-701	Rules for carbon capture and geological storage	N/A	N/A	N/A	Requires that rules be submitted by January 1, 2011, concerning ownership of subsurface rights and pore space	N/A	N/A	
West Virginia	W. Va. Code § 22-11A-6 (2011)		N/A	"Carbon dioxide sequestration" means the injection of carbon dioxide and associated constituents into subsurface geologic formations intended to prevent its release into the atmosphere (22-11A-2)	"'Carbon dioxide sequestration facilities' means the surface equipment used for transport, storage and injection of carbon dioxide, excluding pipelines used to transport carbon dioxide from one or more capture facilities to the sequestration injection site or sites." "'Carbon dioxide sequestration site' means the underground carbon dioxide formations where the carbon dioxide is stored or is intended to be stored" (22-11A-2)	(h) The working group shall issue a final report to the Legislature by July 1, 2011, which report shall, at a minimum:... (3) Recommend any legislation the working group may determine to be necessary or desirable to clarify issues regarding the ownership and other rights and interest in pore space;		July 10, 2009	
Wyoming	Wyo. Stat. § 35-11-313 to -318	Article 3. Water Quality	N/A	"Geologic sequestration" means the injection of carbon dioxide and associated constituents into subsurface geologic formations intended to prevent its release into the atmosphere (35-11-103)	"Geologic sequestration site" means the underground geologic formations where the carbon dioxide is intended to be stored; (35-11-103) "Geologic sequestration facilities" means the surface equipment used for transport, storage and injection of carbon dioxide. (35-11-103)	Can unitize 1 or more parts of a geologic sequestration site and pool the interests in pore space in the proposed unit area (35-11-315)	must supply addresses of those in unit area and adjacent owners; provide formula for how pore space assigned to owners; unit operating plan (35-11-315) consent of 80% of "pore space storage capacity within the unit area" (35-11-316)	July 1, 2008	

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