ENERGY SECURITY AND CLIMATE STEWARDSHIP PLATFORM FOR THE MIDWEST

Toolkit for Carbon Capture and Storage: Statutory and Regulatory Issues

MGA
Midwestern Governors Association

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Renewable Electricity and Advanced Coal with Carbon Capture
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EXECUTIVE SUMMARY

The Midwestern Governors Association (MGA) endorsed a set of regional goals, policies, and objectives in the Energy Security and Climate Stewardship Platform in 2007. The governors of Iowa, Illinois, Michigan, Minnesota, Ohio, Wisconsin, and the premier of Manitoba endorsed a resolution establishing a Carbon Management Infrastructure Partnership to promote the coordinated near-term development of a regional carbon dioxide (CO_2) transportation and storage infrastructure to support the deployment of advanced coal with carbon capture and storage (CCS) projects in the MGA region as part of a broader greenhouse gas reduction strategy. Two deliverables in the Partnership resolution contribute to addressing and developing a framework for the legal and regulatory issues related to CCS:

- Deliverable 3: Conduct a jurisdictional inventory of regulations governing or potentially governing different aspects of CCS; and
- Deliverable 4: Develop a uniform model state/provincial regulatory framework specific to CO_2 capture, compression, pipelines, and underground injection and storage, informed by emerging federal approaches and the Interstate Oil and Gas Compact Commission (IOGCC) regulations.

An advisory group of participants from across the region, representing diverse interests, was formed in early 2008 to implement these deliverables. A discussion paper for the Carbon Management Infrastructure Partnership was released in May 2008 to frame the issues associated with each deliverable the Advisory Group would be addressing. The advisory group identified a set of issues – ownership issues, transport of CO_2, and liability and financial responsibility – where state/provincial and regional action would be most effective in the development of a regulatory framework for CCS, while acknowledging that several issues may be addressed at the federal level. This paper addresses the state/provincial issues and does not make specific recommendations on actions that should be taken at the federal level.

Initially, an inventory of the MGA region was conducted to gather jurisdictional data regarding regulations and statutes related to CCS and analogous projects such as natural gas storage. This inventory, the "MGA Legal and Regulatory Inventory for Carbon Capture and Storage (CCS) & Analogues," provides a valuable tool for jurisdictions in the region to view the regulatory landscape and see differences across the jurisdictions that may need to coordinate on projects (e.g., an inter-jurisdictional pipeline or a basin with multiple projects).

The Toolkit provides a menu of actions for addressing areas that the advisory group identified at the state/provincial and/or regional level. As evidenced by the inventory, each state/province will be developing rules within its own legal and regulatory structure. The issue areas identified are among the most significant issues for states and provinces to consider and address in order to develop CCS projects. The Toolkit is designed to provide background on each issue identified by the Advisory Group and to provide a menu of actions that states and provinces may evaluate and consider applying or adapting in the context of their jurisdictions.

Transport. The development of a pipeline infrastructure for the transportation of CO_2 will be a key component in the deployment of CCS. Projects that generate and capture CO_2 will need a reliable pathway for CO_2 to be managed and stored. Jurisdictions will have a key role in determining how pipelines are sited and for developing the framework for acquisition of property along the pipeline route. Some jurisdictions in the MGA region have statutes in place for pipelines carrying CO_2 to enhanced oil recovery (EOR) operations, in addition to experience with other types of inter and intra-jurisdictional pipelines. Each jurisdiction will need to identify and develop mechanisms for project developers or pipeline operators to acquire transportation corridors to transport CO_2 for the purpose of storage. This may include:

- Extend eminent domain authority to CO_2 pipelines;
- Include CO_2 pipelines in the definition of a common carrier; and
- Determine the extent to which existing easements may be utilized.

Jurisdictions may develop frameworks and mechanisms that create more efficient siting and permitting processes. This may include:

- Development of an institutional authority that can efficiently manage siting and address multiple pieces of a CCS project (e.g., the Ohio Power Siting Board); and
- Establishment of a Geologic Storage Utility that would manage and distribute CO_2 in a specific jurisdiction and would carry out such duties in perpetuity.

The development of a CO_2 pipeline network in the MGA region would be further supported by efforts to assess and determine potential pathways for pipeline networks. The MGA CO_2 Management Infrastructure Partnership resolution has provisions to conduct a study and proposed siting of a regional CO_2 pipeline system.

Finally, there are issues that may need resolution or development at the state/provincial and federal levels. It will be important for state/provincial/federal cooperation and coordination to identify and address potential issues that may arise with an increase in CO_2 pipeline development. These actions can significantly support the rational build-out of CO_2 pipelines in the MGA region and support the development of advanced coal with CCS projects.

Ownership issues. Project owners or operators of a geologic storage project will be required to obtain the necessary property rights and associated interests to the surface and to the subsurface pore space where CO_2 will be injected and stored. The case law and statutes associated with these interests are primarily a function of state and provincial law. Legal analysis of the issues related to pore space ownership have extensively reviewed case law history related to oil and gas formations and have found significantly less precedent to provide guidance on saline formations. It has been predicted that rights for storage will likely be acquired in a similar fashion for both depleted oil and gas formations and saline formations. The analysis has focused on determining the owner of the pore space between the owner of the land above the pore space (the surface owner) and the owner of other subsurface interests/resources – existing or depleted – in the pore space (e.g., the mineral interest owner). The majority view in the analysis reviewed determines that the surface owner likely has ownership of the pore space (as opposed to another interest such as a mineral owner). The uncertainty related to this issue and the potential for litigation centered on pore space ownership has led several experts to recommend that it may be prudent for geologic storage project owners or operators to acquire both sets of interests. States and provinces may provide clarity on ownership issues by:

- Determining by statute the owner of the pore space;
- Determining the authority to manage property acquisition and the mechanisms for property acquisition (voluntary and non-voluntary mechanisms such as eminent domain and amalgamation of rights);
- Determining at what point resources become depleted in a pore space (or an alternate mechanism for addressing depleted resources); and
- Determining by statute that the injection and geologic storage of CO_2 is an activity in the public interest. This could provide a way for courts to weigh storage interests in relation to other interests.

Pore space owners may be compensated for CO_2 storage activities on their property, and project owners and operators may receive some form of economic benefit for CO_2 storage (e.g., through carbon credits in a cap and trade system). Parties will also be subject to various types of liability for the injection and storage of CO_2. It will be important to develop a structure that clearly identifies the owner(s) of the CO_2 and determines the duration of the ownership. This may be addressed through contractual mechanisms or by the jurisdictional regulatory authority. Potential actions include:

- Developing a framework for the ownership of the CO_2 over different stages of a project; and
- Determining a method to allocate the amount of pore space that each owner in a storage project has an interest in.

Liability and financial responsibility. Geologic storage project owners and operators will be responsible for managing the attendant risks and liabilities of CO_2 injection and storage. The potential for owners and operators to be exposed to long-term or open-ended liability has been identified as one of the key barriers to development of geologic storage projects. The Toolkit outlines the different types of liability that may potentially be associated with a geologic storage project and the situations in which these may apply.

There are several existing and previously applied frameworks for managing risk and liability in other industries. The Toolkit identifies key analysis and frameworks that have been reviewed by experts to provide guidance and lessons learned from other contexts. Several frameworks are being developed and recommended by different organizations to address these issues. Frameworks highlighted in the Toolkit include:

- The IOGCC provides a framework for the transfer of liability and long-term stewardship to the state or province, with the long-term management by the state or province to be supported by an industry-financed trust fund;
- The Clean Air Task Force (CATF) draft discussion paper outlines the creation of a Geologic Storage Utility that would manage and distribute CO_2 for storage, in addition to managing storage sites in perpetuity;
- A Financial Risk Management Framework developed by experts Chiara Trabucchi and Lindene Patton, the main components of which consist of a CCS Safety Board, a CCS National Trust Fund, and a list of enabling legislation to address critical issues; and

- A set of recommendations and guiding principles for financial responsibility developed by the World Resources Institute (WRI) with input from over 80 stakeholders with diverse backgrounds and interests.

Areas for state and provincial action include:

- Evaluating recommended frameworks for ensuring financial viability and managing liability over the long-term for CCS projects, taking into account the lessons learned and the strengths of previous and existing analogous frameworks; and
- Developing a framework to manage liability and provide assurance that those responsible for a project have the ability to fulfill financial responsibility requirements. The framework should be structured to accurately address the risks of a project, provide incentives for safe and effective practices throughout each stage of a project, and to avoid creation of economic barriers to project development.

Finally, supplementary material has been gathered in the Appendix to highlight significant legislative action, recommended rules and best practices, and other guidance material prepared by different entities including stakeholder groups, states, NGO's and the U.S. EPA that will play a significant role in addressing the legal and regulatory issues of developing a CO_2 management infrastructure. Several jurisdictions and organizations have examined and developed model rules, prepared guidance, and passed legislation on CCS issues. States such as Kansas, North Dakota, Washington, and Wyoming have developed and/or passed significant legislation and regulations, and the state of New Mexico has developed a comprehensive 'Blueprint' to guide that state as it develops regulations. Stakeholder groups have also convened and provided significant guidelines and recommendations on CCS, including the IOGCC and WRI. Potential frameworks for addressing liability, financial responsibility, and other key issues are also outlined in the "Recommended Financial Risk Management Framework" (by Trabucchi and Patton) and in a draft CATF discussion paper detailing the development of a Geologic Storage Utility.

The MGA Toolkit for Advanced Coal with Carbon Capture and Storage has been developed in fulfillment of the MGA Platform Carbon Management Infrastructure Partnership resolution to, "Develop a uniform model state/provincial regulatory framework specific to CO_2 capture, compression, pipelines, and underground injection and storage, informed by emerging federal approaches and the Interstate Oil and Gas Compact Commission (IOGCC) regulations."
The purpose of the toolkit is to:

1) Identify the major statutory and regulatory issues and barriers at the state/provincial level to the development of a carbon management infrastructure;
2) Present background on and synthesis of the major issues and barriers that have been analyzed to date;
3) Provide a guide to key resources and model frameworks that have been proposed to address the identified issues and barriers including: key legislation, recommended frameworks, and highlights from other guidance documents; and
4) Offer a menu of actions to address these issues and barriers that may be adapted and applied as appropriate in MGA jurisdictions to support the development of a carbon management infrastructure.

The Toolkit was developed through the MGA process of Advisory Group meetings and communication between the diverse set of stakeholders that make up the MGA Advisory Group on Renewable Electricity and Advanced Coal with Carbon Capture and Storage. This toolkit will be a resource for statutory and regulatory development in the MGA region and other jurisdictions addressing these issues.

This section focuses on the issues that may be addressed at the state, provincial, and/or regional level to support the build-out of a pipeline infrastructure that transports CO_2 between CO_2 sources and sinks (e.g., deep saline formations, depleted oil and gas fields, or unmineable coal seams).[1] Significant efforts are also ongoing at the federal level to examine pipeline siting, technical, and financing issues, in addition to what role the federal government might play as CO_2 pipelines become more widespread. States and provinces will play a role in pipeline siting decisions, shaping the mechanisms for acquiring rights-of-way and in managing and enforcing pipeline safety in cooperation with federal agencies. State, provincial, and federal dialogue will be necessary to facilitate resolution of these issues and to facilitate the rational build-out of a CO_2 transportation infrastructure.[2] The development of such infrastructure will be paramount to the development of a system to manage CO_2.

[1] For a comprehensive discussion on issues related to CO_2 pipelines for CCS and recommended guidelines, *see* World Resources Institute (WRI), "CCS Guidelines: Guidelines for Carbon Dioxide Capture, Transport, and Storage," Washington, DC: WRI (2008), *available at* http://www.wri.org/publication/ccs-guidelines.

[2] *See* US. Congress, *Energy Independence and Security Act of 2007*, P.L. 110-140 P.L. 114-110, 110th Congress. This states that the Secretary of the Interior is required to recommend legislation to clarify the issuance of CO_2 pipeline rights-of way. *See also* the *CO_2 Pipeline Study Act of 2007,* 106th Congress. This Act would address some of these complex CO_2 transportation issues by requiring further study on the feasibility of constructing and operating a network of CO_2 pipelines.

MENU OF ACTIONS

This menu of actions provides potential options that may be adapted and applied to meet specific needs of different jurisdictions.

1. Establish appropriate mechanisms by jurisdiction to enable acquisition of transportation corridors for CO_2 pipelines:
    a. Determine if CO_2 pipelines may be categorized as a common carrier;
    b. Determine whether state statutes related to condemnation through eminent domain may extend to CO_2 pipeline transportation corridors (e.g., North Dakota's statutes extend eminent domain for "public uses" that include oil, gas, coal, and CO_2 pipelines (qualified as common carriers); and
    c. Determine the extent to which existing easements may be utilized by CO_2 pipelines.

    Note: The above actions may be impacted by whether or not a state determines that CCS is in the public interest (e.g., as recommended in the IOGCC Model Rule).
2. Establish a regulatory structure or entity that expedites and/or streamlines the process of siting pipelines while ensuring a safe, efficient and economic pipeline infrastructure build-out.
    a. Example: The Conceptual Geologic Storage Utility that would manage and distribute the CO_2 within one regulated utility. [See Appendix B for full discussion paper prepared by the Clean Air Task Force (CATF)]
    b. Example: Ohio Power Siting Board – a 'one-stop shop' for state siting of energy facilities.
    c. Example: Address eminent domain provisions under one statutory authority for storage and transport of CO_2. The IOGCC has suggested an option to combine hearings related to geologic storage site licensing with eminent domain hearings by regulatory agencies.

    Note: These examples could be applied to more than one phase of a project.
3. Support efforts to assess and determine potential pipeline networks to allocate resources effectively and economically in order to accelerate deployment of CCS in the MGA region.
    a. For example, Deliverable 5 of the CO_2 Management Infrastructure Partnership resolution calls for a study and proposed siting of a regional CO_2 pipeline system.
4. Encourage resolution of issues at the federal level and/or suggest areas for state/provincial/federal cooperation and coordination to streamline siting and permitting processes.

Background

The United States has significant experience in transporting CO_2 through pipeline networks spanning more than 3,900 miles for industrial purposes and for injection and hydrocarbon production in EOR operations.[3] Issues related to CO_2 pipelines that may need to be addressed in the context of CCS include pipeline siting, design, operations, and pipeline safety for transporting CO_2. The development of new or amended approaches to CO_2 pipelines will stem from the requirements of a pipeline network that will be significantly more extensive, will cross new jurisdictions and boundaries, and will transport CO_2 for the purposes of both geologic storage of CO_2 and for EOR. CO_2 pipelines are currently concentrated in New Mexico, Texas, and Wyoming with 66 percent of CO_2 pipelines crossing state boundaries and 34 percent operating intrastate.[4] The development of a pipeline framework for CCS will evolve within an existing framework created for EOR where CO_2 is transported to facilitate maximum hydrocarbon production. The new or adapted framework for CCS will be developed for transporting CO_2 with the goal of providing various industries a safe and effective sink for CO_2 storage.[5]

Siting

Siting of pipelines is largely determined by state and provincial law and rights-of-way are acquired by purchasing easements or by condemnation of property through eminent domain after approval of a pipeline route.[6] For example, gas pipeline developers in Manitoba must gain approval from the Manitoba Public Utilities Board (PUB) to construct a pipeline. The PUB may

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[3] Joseph T. Kelliher, "Testimony of the Honorable Joseph T. Kelliher, Chairman Federal Energy Regulatory Commission," United States Senate, Committee on Energy and Natural Resources, *Oversight Hearing on Construction and Operation of Carbon Dioxide Pipelines* (31 January 2008), *available at* http://www.ferc.gov/congress/cong-test/kelliher.asp.

[4] Krista L. Edwards, "Written Statement of Krista L. Edwards, Deputy Administrator, Pipeline and Hazardous Materials Safety Administration, U.S. Department of Transportation," Before the Committee on Energy and Natural Resources, United States Senate, *Oversight Hearing on Construction and Operation of Carbon Dioxide Pipelines* (31 January 2008), *available at* http://energy.senate.gov/public/_files/EdwardsTestimony013108.doc.

[5] For an extensive analysis of the issues involved with developing a framework for CO_2 pipelines from an EOR context to the CCS context, *see* Philip M. Marston and Patricia A. Moore, "From EOR to CCS: The Evolving Legal and Regulatory Framework for Carbon Capture and Storage," *Energy Law Journal 29*, no.2 (2008): 448 – 465, *at* http://www.eba-net.org/docs/elj292/421_-__eor_to_ccs-clean_final_print_11-2-08.pdf.

[6] U.S. Congressional Research Service (CRS), *CRS Report RL34316*, "Carbon Dioxide (CO_2) Pipelines for Carbon Sequestration: Emerging Policy Issues," Resource, Science, and Energy Division, by P.W. Parformak and P. Folger (19 April 2007), 8-10.

expropriate land and determine compensation to property owners if there is no voluntary agreement on land acquisition.[7] Siting of CO_2 pipelines on a significantly larger scale than the existing network and in jurisdictions with no existing CO_2 pipelines will require clarification of how to secure rights-of-way, of eminent domain laws (if applicable), and considerations for siting near populated and ecologically sensitive areas.[8] Some projects may be located in close proximity to a formation that is suitable for geologic storage, whereas other projects will have to connect CO_2 sources and geologic storage formations or 'sinks' located far apart from one another. Projects that connect distant sources and sinks will require clear and efficient mechanisms to acquire rights-of-way. Reducing the potentially lengthy time period for permitting and acquisition of transportation corridors can reduce cost and provide more certain pathways for project development. Jurisdictions may provide mechanisms or structures for streamlining the permitting and land acquisition process that protect the interests of landowners while ensuring the safe and efficient build-out of pipelines. Many stakeholders have expressed the concern that multiple agencies and levels of authority could impede an economic and efficient development of pipelines that are critical to a broader infrastructure for CO_2 management in the region.

Jurisdictions may consider adapting eminent domain statutes and the definition of a common carrier to include CO_2 pipelines, subject to jurisdictional criteria and requirements. For example, North Dakota has several statutes and mechanisms for the encouragement of pipeline development including: CO_2 pipelines may be classified as common carriers;[9] eminent domain extends to 'public uses' including oil, gas, coal, and CO_2 pipelines;[10] and the state has created a Pipeline Authority to support the development of pipelines. The ND Pipeline Authority may "participate in a pipeline project through financing, planning, development, acquisition, leasing, rental, joint ownership, or other arrangements."[11] Another example in the MGA region is the Illinois Eminent Domain Act:

> "[The Illinois Eminent Domain Act] specifically provides that quick take proceedings may be used by the Illinois Department of Commerce and Economic

[7] MGA Inventory (2009): Manitoba.
[8] CRS, 8.
[9] North Dakota Century Code (N.D.C.C.) § 49-19-12.
[10] N.D.C.C. ch. 32-15 (Eminent Domain).
[11] N.D.C.C. ch. 54-17.7 (Pipeline Authority), *at* http://www.legis.nd.gov/cencode/t54c177.pdf. More information on the North Dakota Pipeline Authority *available at* https://www.dmr.nd.gov/pipeline/assistance.asp.

> Opportunity for purposes specified in the Illinois Coal and Energy Development Bond Act. *See* 735 ILCS 30/25-7-103.3 The Coal and Energy Development Bond Act provides that the power of condemnation shall be exercised solely for the purposes of siting, rights-of-way, or easements appurtenant to coal utilization or coal conversion projects. 20 ILCS 1110/3(c). The land needed for the CO_2 pipeline qualifies as a right-of-way appurtenant to a coal utilization project."[12]

The Midwest Regional Carbon Sequestration Partnership (MRCSP) characterized the task and the goals for developing a regulatory regime for a widespread build-out of CO_2 pipelines in its 2006 Final Report:

> "The fundamental objective for regulators must be to create a comprehensive and effective regime. Agencies with possible overlapping jurisdiction, both federal and state, should seek to cooperate to develop an appropriate regulatory framework before CO_2 sequestration becomes widespread. This will not only help to ensure the protection of human health and ecosystems, but will also provide regulatory certainty for the companies concerned."[13]

The MRCSP Final Report goes on to discuss the merits of a "one-stop siting agency" and offers the Ohio Power Siting Board (OPSB) as such a model that has a coordinating agency with the capacity to address all aspects of siting a CCS project.[14] The eleven member (seven voting and four non-voting) OPSB brings all the entities involved in the project siting process together in an integrated fashion with clear and binding timelines for decision-making. The voting members include the: Chair of the OPSB (the Chair of the Public Utilities Commission Ohio), Ohio EPA, Ohio DNR, Ohio DOD, Ohio DOH, Ohio DOA, and a public member.[15] The non-voting members consist of legislators (two Senators and two House Representatives).

Overview of Current Pipeline Regulations

Federal Regulation

A CO_2 pipeline is defined by the US Department of Transportation's (DOT), Pipelines and Hazardous Materials Safety Administration (PHMSA), Office of Pipeline Safety (OPS), as a pipeline carrying a fluid that is composed of 90 percent or more CO_2 in a supercritical state. Currently, CO_2 pipeline operators set their own rates under the Interstate Commerce Commission

[12] *See* MGA Legal and Regulatory Inventory for Carbon Capture and Storage & Analogues (2009): Illinois.

[13] Midwest Regional Carbon Sequestration Partnership (MRCSP), *Phase 1 Final Report,* DOE Cooperative Agreement No.DE-FC26-03NT41981, Submitted by Battelle (2005), 196.

[14] Ibid, 38 – 47.

[15] The OPSB website states that "the public representative, who must be a licensed engineer, is appointed by the Governor from a list of nominees submitted by the Ohio Consumers' Counsel." Information about the OBSP can be found *at* http://www.opsb.ohio.gov/opsb/about.cfm.

Termination Act (ICCTA) of 1995. The US DOT Surface Transportation Board (STB) regulates rates and ensures common carrier requirements are met for CO_2 pipelines only when a complaint is filed by a third party. This framework for economic regulation has worked for the existing level of CO_2 pipeline infrastructure but may need to be adapted as the infrastructure expands and crosses new jurisdictions (including state/provincial and federal lands where additional requirements apply). Safety regulations and enforcement for CO_2 pipelines are administered by the DOT PHMSA OPS, often in partnership with states.[16] Carbon dioxide is classified by the DOT regulations as a Class 2.2 (non-flammable gas) hazardous material and is under the same regulations as hazardous liquids in the context of pipeline transportation.

Jurisdictional regulation

In the US, states may apply to directly regulate the safety of their intrastate pipelines through annual certification by the OPS and may obtain the authority to inspect interstate pipelines within their jurisdiction.[17] Iowa, Michigan, Minnesota and Ohio are states in the MGA region that are currently certified for both intrastate regulation and to act as interstate agents. Through certification by OPS, these states regulate, inspect, and enforce intrastate gas pipeline safety requirements. For example, Minnesota additionally regulates, inspects, and enforces intrastate hazardous liquid pipeline safety requirements and acts as an interstate agent. This work is performed by the Minnesota OPS within the State Fire Marshal Division of the Minnesota Department of Public Safety.[18] In Manitoba, natural gas pipelines are the responsibility of the Public Utilities Board and the National Energy Board is responsible for lines that cross provincial boundaries. As the pipeline infrastructure expands and the numbers of operators increase, the existing regulations may need to be modified to mitigate potential issues that could impede the development of pipelines and associated CCS projects.[19]

Regulatory Analogues – oil and gas pipelines

Oil and gas pipelines are instructive regulatory analogues for the regulation of a network of CO_2 pipelines. Interstate oil pipelines are sited under state authority with transportation rates set by the Federal Energy Regulatory Commission (FERC) and safety regulations administered by PHMSA OPS. Interstate natural gas pipelines are sited and have transportation rates set by

[16] Ibid, 7 – 15.

[17] *See* MGA Inventory (2009) for how each state regulates pipelines and what agencies within each state have authority over pipeline regulation.

[18] *See* Ibid, Minnesota.

[19] For detailed discussion, *see* CRS Report for Congress (2007), 7-10; MRCSP (2005), 38-47; Kelliher (2008).

FERC. Federal authority for siting pipelines in the US was extended over natural gas pipelines in order to fill in the gaps left by state regulation.[20] Safety regulations that are administered by FERC during siting and construction are subsequently transferred to PHMSA during operations.[21] The common carrier approach (oil) and the public utility approach (gas) have developed over time and provide instructive examples for stakeholders looking at the potential development of regulation for CO_2 pipeline networks.[22]

Role of Federal Regulation

The US Congressional Research Service (CRS) has written a series of papers that address the potential questions regarding an expanded federal role (namely beyond the current DOT PHMSA OPS and the STB authority as detailed above) in CO_2 pipeline regulation. The federal institutions - including FERC and the STB - that would potentially have new or expanded authority over CO_2 pipelines have not indicated to date that new or expanded authority is warranted or valid under existing statute. The CRS first discusses the status of CO_2 pipelines under the authority of the STB and FERC as stated in Cortez Pipeline Co., 46 Fed. Reg. 18805 (1981) (Interstate Commerce Commission (ICC)/now the Surface Transportation Board). As stated by (then) FERC Chairman Joseph Kelliher, Cortez states that CO_2 pipelines are:

> "not subject to its [the STB's] jurisdiction. The Cortez Pipeline case was also brought to the Federal Energy Regulatory Commission (FERC), under the Natural Gas Act, where they stated that a pipeline carrying 98% of CO_2 with traces of methane is be outside of the FERC jurisdiction."[23]

The CRS report discusses other interpretations that indicate federal authorities, namely the STB or FERC, may in fact exercise authority over CO_2 pipelines. In a personal communication to the CRS, the STB stated that it would not address the issue of their jurisdiction unless it was brought before them in a dispute. The potential interpretation the STB could use if a dispute was raised may be based on a number of assertions: the fact that the ICC which ruled on Cortez is not the same agency as the STB; a Government Accountability Office (GAO) report from 1998 asserts

[20] Kelliher (2008).
[21] Ibid.
[22] Mark A. de Figueiredo, Howard J. Herzog, Paul L. Joskow, Kenneth A. Oye, and David M. Reiner, "Regulating Carbon Dioxide Capture and Storage," MIT Center for Energy and Environmental Policy Research Working Paper 07-003 (2007),1-5.
[23] Kelliher (2008).

that CO_2 and other gas pipelines are in fact under STB authority; and finally that the Supreme Court holds that agencies may modify how they interpret their authority and policy.[24]

Further to the issue of federal involvement, Kelliher stated in a January 2008 Senate hearing that:

> "In particular, I would not recommend that Congress preempt the states on siting carbon dioxide pipelines, by providing for exclusive and preemptive federal siting of carbon dioxide pipelines. The precondition that led Congress to such a course for siting natural gas pipelines – the failure of state siting – does not exist here. Further, I would not recommend that Congress alter PHMSA's safety role."[25]

Kelliher acknowledged that the three models of pipeline regulation in the US could all likely be applied to CO_2 pipelines in the CCS context. Kelliher further asserted that he did not see gaps in the regulation of CO_2 pipelines today nor could he identify a similar need (referring to the case of the natural gas industry) in today's CO_2 pipeline industry, thus recommending that it remain outside of FERC's authority.

Conclusion

It will be important to create clearly delineated and streamlined pathways for CO_2 pipeline development at the state/provincial level and federal level. Such an approach will move the MGA region towards achieving a level of infrastructure envisioned for a network that can support a region-wide transition to CCS. The level of infrastructure to support comprehensive CO_2 management will require cooperation and integration between multiple sectors, communities, constituencies, and levels of government. The public sector can identify ways to effectively leverage and allocate resources in a fashion that accelerates development of a network versus a system that evaluates each project or each CO_2 source and sink in isolation. States and provinces are some of the key parties that can develop strategies for addressing these issues and will have to work together with other parties to build a pipeline network that can support the regional MGA goals of incorporating CCS in all new coal-based power plants by 2020 and of transitioning all existing coal-fired generation to CCS by 2050.

[24] U.S. Congressional Research Service (CRS), *CRS Report RL34307*, "Regulation of Carbon Dioxide (CO2) Sequestration Pipelines: Jurisdictional Issues," Resource, Science, and Energy Division, by Adam Vann and Paul W. Parformak (15 April 2008), 5-6.

[25] Kelliher (2008).

OWNERSHIP ISSUES FOR GEOLOGIC STORAGE

This section focuses on ownership issues for geologic storage of CO_2. This primarily involves the ownership of the pore space that will receive and store the injected CO_2, the surface land needed to be accessed and utilized, and the ownership of the CO_2. The ownership of pore space has been identified as one of the major issues that need to be resolved for developing CCS projects. States and provinces will develop the mechanisms and legal structure within which project developers will acquire or lease the necessary rights to inject and store CO_2. The area of a project for geologic storage may involve a large number of rights that must be acquired or leased related to surface rights, mineral rights, and water rights depending on the type of formation (primarily deep saline formations, depleted oil and gas formations, and unmineable coal seams) and location of the project.

MENU OF ACTIONS

This menu of actions provides potential options that may be adapted and applied to meet specific needs of different jurisdictions.

1) Pore space ownership:
    a. Develop legislation to define the ownership of pore space for the different types of formations where CO_2 would be stored, namely saline formations and depleted oil and gas reservoirs (See Appendix A and E for examples: IOGCC Model Rule and North Dakota and Wyoming legislation defining pore space rights); and
    b. Determine the extent of rights (e.g., the expected project footprint) that must be acquired to obtain a permit. Elements of a project footprint could include the expected areas of impact for the plume, pressure front, and displaced brine.
2) Acquisition of property rights for storage:
    a. Determine the authority to manage property acquisition and the mechanisms for enabling the acquisition of necessary property rights;
    b. Provide for access to surface property for the purpose of site characterization, operations, and MMV activities;
    c. Develop legislation for the amalgamation of pore space rights within a storage formation (See Appendix A and E for examples for state examples in Wyoming and North Dakota);

MENU OF ACTIONS (cont'd)

d. Determine long-term geologic storage of CO_2 as an activity that is in the public interest (See Appendix A and E for examples); and
e. Determine if eminent domain may be used as a mechanism to acquire rights after good faith efforts have been made to acquire rights in a voluntary manner.
   - Determine how owners of the pore space may be compensated. Any mechanism should balance the interests of owners with the public interest in development of geologic storage projects.

3) Ownership of CO_2:
   a. Develop a framework for the ownership of the CO_2 over the different stages in the CCS project chain.
4) Ownership issues in depleted oil and gas reservoirs: Define or develop criteria to determine when a formation is deemed 'depleted' of hydrocarbons.
   a. Recognize the potential economic value of stranded and/or residual oil resources in the framework so as to not preclude future EOR activities where appropriate.

Background

Jurisdictions that develop long-term geologic storage projects will need to identify and address the property interests related to surface areas needed to access, operate, and manage a geologic storage project over time and to the subsurface areas needed to store and manage the CO_2. With the exception of federal lands,[26] the relevant property interests are defined by state and provincial law and vary by jurisdiction. States and provinces will need to identify the relevant property interests and determine how those interests will be balanced and acquired by those entities operating and managing geologic storage projects. Further, jurisdictions will need to clearly identify the mechanisms for geologic storage project developers to acquire the necessary property rights, whether through voluntary and/or involuntary means. A framework for clearly

[26] Forthcoming report as required by *H.R.6, Section 714*, of the *Energy Independence and Security Act* (2007) in December 2008 by the US Department of the Interior on a framework for managing geologic sequestration projects on federal land (including property interests). For a list of the forthcoming recommendations, s*ee* C. Stephen Allred, "Statement of C. Stephen Allred, Assistant Secretary for Land and Minerals Management, U.S. Department of the Interior," United States Senate, Committee on Energy and Natural Resources, *Full Committee Hearing: To receive testimony on carbon capture, transportation, and sequestration and related bills, S.2323 and S.2144* (31 January 2008). Federal authority may also be extended to geologic storage projects where interstate commerce is involved, as discussed in M.A. de Figueiredo, "The Liability of Carbon Dioxide Storage," Ph.D. Thesis, MIT Engineering Systems Division (2007), 196.

identifying and managing the potentially large number of interests impacted by a geologic storage project will be needed to effectively and efficiently develop projects.

The property interests that will need to be identified and acquired will be different depending on the geologic formation being utilized to sequester the CO_2. A depleted oil and gas formation will primarily involve mineral interests in the hydrocarbons and the surface estate whereas a saline formation will involve water interests and the surface estate. Property law is well developed in the area of oil and gas bearing formations and for natural gas storage but there is relatively little case law to reference that may apply to geologic storage in saline formations. Saline formations will likely involve interests in groundwater that are also largely governed by state and provincial law. Interests in different storage formations will vary yet the mechanisms for acquiring rights to store CO_2 will likely be similar.

Jurisdictions must also create a structure that determines ownership of the CO_2 during each phase of a geologic storage project – both in terms of which entity has ownership and for what time period or specified performance criteria has been met. This will also influence which parties are compensated for any carbon credits or other economic benefit that may be allocated for CCS over time.[27] The ownership of CO_2 will further impact which party is liable and during what time period/phase of a project. Project operators may receive credit for long-term storage in a future climate framework while also being held liable for any negative impacts to local and global human health, the environment, and other property interests (addressed by tort liability) in addition to being penalized for leakage if an owner or operator has been compensated for storage (addressed by contractual liability). The IOGCC recommends that the owner of a storage project would maintain ownership and liability for the CO_2 throughout the operational and closure periods. The liability would be released after certain requirements have been met and subsequently transferred to the State Regulatory Agency or otherwise designated governmental body.[28]

[27] *See* Wyoming House of Representatives, HB 80, 60th Legislature (2009) for an example of how a state may address the allocation of economic benefits from storage. *Available at* http://legisweb.state.wy.us/2009/Enroll/HB0080.pdf.

[28] The IOGCC approach to liability is discussed further in the Liability section of the Toolkit.

Pore space ownership

Previous analysis of case law outlines the issues and precedent that may apply to pore space ownership for geologic storage projects.[29] Different models have been discussed to frame the potential approaches for addressing pore space ownership. From the perspective of private ownership, property owners (likely the surface owner) would have ownership over the subsurface pore space and lease or sell rights to the pore space for storage. Legislation may be authorized to provide for condemnation of the pore space through eminent domain and amalgamated in a similar way to unitized mineral rights (through voluntary and involuntary measures).[30] From the perspective of a public interest model, authority to limit private property ownership would be extended to the state, provincial, or federal government. This could limit property rights in a similar way to the private property limitations created by federal governance of air space in the interest of public safety that is justified by the lack of impact this would have on the use and value of private property.[31] Ownership of pore space is a different case than that of air space because there is a substantial body of case law related to private subsurface ownership and a history of subsurface use.

The framework developed for addressing property interests will in turn shape the short and long-term liability for a storage project. An operator may be liable for trespass, damages to other property interests, and for CO_2 that does not remain stored within the project boundary (whether

[29] *See* case law analysis in: Interstate Oil & Gas Compact Commission (IOGCC),"Storage of Carbon Dioxide in Geologic Structures, A Legal and Regulatory Guide for States and Provinces, Part 1: Analysis of Property Rights Issues Related to Underground Space Used for Geologic Storage of Carbon Dioxide" (25 September 2007); New Mexico Energy, Minerals, Natural Resources Department (EMNRD), Oil Conservation Division (OCD), *Blueprint for the regulation of geologic sequestration of carbon dioxide in New Mexico*, prepared by Mark Fesmire, Adam Rankin, David Brooks, and William V. Jones (1 December 2007); De Figueiredo, "The Liability of Carbon Dioxide Storage" (2007); E.J. Wilson, M. de Figueiredo, "Geologic Carbon Dioxide Sequestration: An Analysis of Subsurface Property Law," *Environmental Law Institute*, 36 ELR 10114, 21 (2006); Ian J. Duncan, Scott Anderson, and Jean-Philippe Nicot, "Pore space ownership issues for CO2 sequestration in the U.S.," presented at the *9th International Conference on Greenhouse Gas Control Technologies* (November 2008), *available* via Science-Direct in the Spring of 2009 and *available at* https://www4.eventsinteractive.com/iea/viewpdf.esp?id=270005&file=%5C%5Cserenity%5CEP11%24%5CEventwin%5CPool%5Coffice27%5Cdocs%5Cpdf%5Cghgt%5F9Final00648%2Epdf.

[30] Discussed in WRI (2008): 81, from de Figueiredo, The Liability of Carbon Dioxide (2007).

[31] Ibid. *Also see United States v. Causby*, 328 U.S. 256 (1946) to view the case that most prominently limited private property rights in relation to air space.

through leakage or seepage through the surface, subsurface, or by escaping into the atmosphere).[32]

Several reviews of relevant case law have asserted that the majority view among states is that the surface owner would have ownership over the pore space.[33] Further, the right to the pore space may be separate from other interests in the subsurface that may be present in a formation, such as oil or groundwater. Some legal analysis has stated that there may be evidence from case law that asserts the mineral estate as the owner of the pore space yet this is deemed to be a minority interpretation[34] (and may not be valid precedent in the context of geologic storage projects).[35] Common law states that the surface owner owns the land above and underlying their property (including the subsurface geologic formation). This comes from the common law doctrine stating that, "to whomever the soil belongs, he also to the sky and to the depths."[36] This was prominently limited in *United States v. Causby*, 328 U.S. 256 (1946) where landowner rights to air space were limited and could be placed in the public domain because the use of air space for flights had no adverse impact on the future reasonable use and value of the land. The potential application of this analogy in support of a placing pore space rights in the public domain is limited by the fact that there is a long history of private ownership and use of the subsurface. In the MGA region, North Dakota clarifies pore space ownership through legislation determining that: the pore space title is vested in the surface owner and that it cannot be severed from the surface owner; title to the pore space is conveyed with the conveyance of the surface property and may not be severed from the property; and the pore space may be leased from the surface owner. The North Dakota legislation does not apply to pore space that has previously been severed from the surface estate.[37] The uncertainty related to pore space ownership has been

[32] Intergovernmental Panel on Climate Change (IPCC), *Carbon Dioxide Capture and Storage: Summary for Policymakers and Technical Summary*, Eds. B. Metz, O. Davidson, H. De Coninck, M. Loos, and L. Meyer, Geneva (2005), 11 -14. *Available at* http://www.ipcc.ch/ipccreports/srccs.htm.

[33] For detailed discussion of pore space ownership issues s*ee*: IOGCC (2007); EMNRD (2007); de Figueiredo, "The Liability of Carbon Dioxide Storage" (2007); Wilson and de Figueiredo (2006); WRI (2008).

[34] In this context, a minority interpretation means that a fewer number of courts have taken a certain position or interpretation in their rulings.

[35] Duncan et al. (2008): 4-5; EMNRD (2007), 20 - 24.

[36] *Cjus est solum, ejus est usque ad coelum et ad inferos.* This has been translated as "To whomever the soil belongs, he owns also to the sky and the depths." *Black's Law Dictionary*, 6th ed. (1990).

[37] North Dakota State Senate, S.B. 2139*,* 61st Legislative Assembly Session (2009).

clarified by some jurisdictions through legislation and discussed at length in several publications yet has not been tested to date in court in the US or in Canada.

Depleted oil and gas formations

Many of the geologic formations that may be suitable candidates for geologic storage in the near-term in the MGA region may also contain significant mineral resources. Jurisdictions in the MGA that have oil and gas formations that may be suitable candidates for geologic storage include Illinois, Indiana, Kansas, Michigan, North Dakota, and Ohio. The rights to minerals (the mineral estate) may be 'severed' from the surface estate in previous property transactions in some jurisdictions. For example, a previous owner may have sold their surface rights while retaining rights to the mineral resource. This separation is referred to as the severance of the mineral and surface estates. The view that the surface owner retains ownership to the pore space, even after the mineral right has been severed, has been applied in the natural gas storage context in Louisiana, Michigan, and West Virginia.[38] The surface owner gains the right to the storage space once the minerals have been depleted (the definition of 'depleted' may vary in different contexts). In the MGA region, the Michigan Court of Appeals held in the *Department of Transportation v. Goike 560 N.W.2d 365,366 (Mich. Ct. App. 1996)* that the underground storage space "evacuated of the minerals and gas, belongs to the surface owner." The court stated that the storage space is not part of mineral and gas rights. They looked to the "plain and ordinary meaning" of mineral and gas rights as a "right to the minerals themselves, not the land surrounding the minerals."[39] Further, they clarify that the mineral estate owner may store native fluid minerals or gas but may not do so with "foreign or extraneous minerals or gas" and that this right rests with the surface owner (*Department of Transportation v Goike (1996)*.[40] The alternate view that the mineral owner retains the right to the space left after oil and gas has been

[38] Mark de Figueiredo, "Property Interests and Liability of Geologic Carbon Dioxide Storage," *A Special Report to the MIT Carbon Sequestration Initiative* (September 2005): 7-8. De Figueiredo states that in West Virginia's *Tate v. United Fuel Gas Co.* (1952), the court found that the mineral rights extended to the production of minerals and not to the space left behind after those minerals had been evacuated. Thus the mineral estate did not have the rights to store natural gas in the depleted formation – the depleted formation was part of the surface estate rights; Also *see Tate v. United Fuel Gas Co*., 137 W.Va. 272, 282, 71 S.E.2d 65, 72 (1952) as cited in de Figueiredo, The Liability of Carbon Dioxide Storage (2007), 288.

[39] MGA Inventory (2009): Michigan. The court found their holding consistent with the following cases: *Great Lakes Sales, Inc v State Tax Comm*, 194 Mich. App 271; 486 NW2d 367 (1992); *United States v 43.42 Acres of Land*, 520 F Supp 1042 (WD La, 1981), *Southern Natural Gas Co v Sutton,* 406 So 2d 669, 671 (La App 2d Cir, 1991), *Emeny v United States*, 412 F2d 1319 (Court of Claims, 1969); *Ellis v Arkansas Louisiana Gas Co*, 450 F Supp 412 (ED Okla, 1978), aff'd 609 F2d 436 (CA 10, 1979).

[40] Ibid.

depleted was based in part on a lack of knowledge of how certain minerals acted in the subsurface. Because it is now known that minerals will not "refill" a depleted reservoir:

> "…it only makes sense that he [the surface owner], rather than the mineral owner, owns depleted reservoirs. The 'container' in which minerals are locked should not be considered a part of the mineral estate." Fred McGaha, *Underground Storage: Opposing Rights and Interests,* 46 La. L. Rev 871, 873 (1986).[41]

If the minerals have not been depleted, an operator would likely need to acquire both the mineral and surface estates and/or compensate both owners to proceed with a project.

Limitations to the mineral estate

The mineral estate has been dominant in jurisdictions with a history of oil and gas production but has been limited over time through various statutes. Jurisdictions have varying definitions of what constitutes a mineral interest and how the mineral interest is balanced against other property interests. The general definition includes minerals in place in addition to oil and gas that are mobile and have the potential to flow within and across properties within the subsurface. The dominance of the mineral estate allows the mineral owner the right to access minerals through use of the surface estate even when those rights have been severed. This is limited in many jurisdictions through the doctrine of accommodation that gives due regard to surface estate interests and preserves the reasonable use of property by prohibiting adverse impacts to the reasonable use of the surface estate, particularly when there are alternative mechanisms for mineral extraction.[42] Under the doctrine of accommodation the surface estate owner must prove that the reasonable use of their property is impaired by the mineral project's activities. Several states have passed legislation to provide protections under this doctrine including: Texas, Utah, North Dakota,[43] Arkansas, New Mexico and West Virginia.[44] States have also protected surface estates beyond common law doctrine by passing statutes that require compensation for damages

[41] As cited in EMNRD (2007), 20.

[42] *See* Christopher S. Kulander, "Split estate and site remediation issues on tribal lands," *Texas Journal of Oil, Gas & Energy Law*, Volume 2 (2007). Kulander cites: *Getty Oil v. Jones*, 470 S.W.2d 618, 621-22 (Tex.1971); *Flying Diamond Corp. v. Rust*, 551 P.2d. 509 (Utah, 1976); *Diamond Shamrock Corp. v. Phillips*, 511 S.W.2d 160, 163 (Ark. 1974); *Amoco Prod. Co. v. Carter Farms Co.*, 703 P.2d 894, 896 (N.M. 1985); and *Gerrity Oil & Gas Corp. v. Magness*, 946 P.2d 913, 926 (Colo. 1997) ("an aggrieved surface owner may bring a common law action in tort against an operator who has used the surface in an unreasonable manner").

[43] *See* N.D. C.C. § 38-11.1-04, http://www.legis.nd.gov/cencode/t38c111.pdf.

[44] Christopher M. Alspach, "Surface Use by the Mineral Owner: How much accommodation is required under current oil and gas law?" *Oklahoma Law Review 55,* no. 1 (Spring 2002): 89. *Available at* http://www.oscn.net/applications/oscn/deliverdocument.asp?citeid=413107.

to the surface estate. For example, North Dakota requires oil and gas operators to compensate surface owners, "for loss of agricultural production and income, lost land value, lost use of and access to the surface owner's land, and lost value of improvements caused by drilling operations."[45]

Unitization: the amalgamation of property interests

Jurisdictions looking to models of how to manage property interests and utilize pore space resources most effectively may look to the practice of unitization[46] in the oil and gas industry. Unitization was developed on a jurisdictional basis as a strategy to conserve oil and gas resources that are recognized as a public good and to provide a framework for mineral estate owners to produce oil and gas commonly held in one reservoir. Most oil and gas jurisdictions have passed statutes that create a threshold amount of owners within a field that must voluntarily agree to be part of a unit before requiring compulsory unitization of remaining owners. States and provinces considering mechanisms to manage the acquisition of property rights may look to this model for geologic storage projects. For example, North Dakota SB 2095 states, "If a storage operator does not obtain the consent of all persons who own the storage reservoir's pore space, the commission may require that the pore space owned by nonconsenting owners be included in a storage facility and subject to geologic storage.[47]

Project operators making the transition from operating a CO_2-EOR project to a CO_2-storage project will need to clearly identify any additional property interests that need to be acquired and how existing contracts may need to be modified.[48] It has been estimated that larger areas would likely need to be unitized for a CO_2-EOR project transitioning to storage because of the area needed to accommodate the migration of an increased amount of CO_2. This may create difficulty as the number of interests would increase beyond those originally part of the project.[49] Legal experts Philip M. Marston and Patricia A. Moore have examined these issues and have recommended areas for regulatory and contractual adjustments to the existing EOR framework in

[45] *See* N.D.C.C. § 38-11.1: Oil and Gas Production Compensation http://www.legis.nd.gov/cencode/t38c111.pdf.

[46] The voluntary or compulsory joining of oil and gas rights within a formation is called unitization.

[47] North Dakota Senate, S.B. 2095, 61st Legislative Assembly Session (2009).

[48] *See* Marston and Moore (2008) for recommendations on how to apply existing law and adapt contracts to allow for CO_2-EOR projects to transition to geologic storage.

[49] EMNRD (2007), 36.

addition to identifying gaps that need to be addressed for EOR projects to transition to geologic storage projects.[50]

Saline formations

Saline formations will likely be the most significant resource for the geologic storage of CO_2 in the US over the long-term. In the near term, saline formations have not been well characterized in comparison to oil and gas formations where previous operations have gathered data for other purposes. Further, there is relatively little case law associated with saline formations to provide guidance on ownership issues in comparison with the case law associated with oil and gas formations. States and provinces can look to the authority and frameworks established for surface and groundwater rights and the interests involved. Case law on groundwater issues previously focused on "the taking and use of groundwater for consumption."[51] State and provincial law varies between private vs. public ownership of different classifications of water and of the formation that holds the water resource.

The acquisition of rights for geologic storage in saline formations will likely be determined in a similar way to the acquisition of rights for geologic storage in a depleted oil and gas reservoir.[52] New Mexico's Energy, Minerals, and Natural Resources Department (EMNRD) conducted a review and analysis of case law that may apply to the different formations utilized for geologic storage projects. The EMNRD reviewed a 2006 U.S. 10th Circuit Court of Appeals finding that asserts through a case on a trespass action that the state did not own rights to the formation (that holds the water) in the same way that it owns the public's water in trust. The Court's finding asserts that, "the State as guardian of the public trust has no possessory interest in the sand, gravel, and other minerals that make up the formation – a necessary requisite to maintaining a trespass action."[53] Jurisdictions may need to determine if the saline formation itself is included in the public domain in the same way that groundwater may be. Further, state and provincial water law frameworks will likely apply to a saline formation.[54] The MGA is in a region that is

[50] Marston and Moore (2008): 472-482.

[51] De Figueiredo, "Property Interests and Liability of Geologic Carbon Dioxide Storage" (2005): 9.

[52] Ibid; EMNRD (2007), 24-26.

[53] *New Mexico v. General Elec. Co.,* 335 F. Supp. 2d 1266 (D.N.M. 2004) aff'd *New Mexico v. General Elec. Co.*, 467 F.3d 1223 (10th Cir. 2006), as cited in EMNRD (2007), 25 – 26.

[54] Mark A. De Figueiredo, "Property Interests and Liability of Geologic Carbon Dioxide Storage," in *Carbon Capture and Sequestration: Integrating Technology, Monitoring, and Regulation*, eds. E.J. Wilson and D. Gerard (Ames, Iowa: Blackwell Publishing Professional, 2007), 247.

situated across the varying geography of water rights regimes that grew out of a lack of water (in the West) or an ample amount of water (in the East). These frameworks will impact which interests are affected by storage in a saline formation and how the interests may be weighed.

There are 5 common legal regimes for groundwater rights applied within the MGA region: absolute ownership[55] (Indiana); reasonable use[56] (Illinois, Michigan, Minnesota, Missouri (adopted this along with prior appropriation), Nebraska (adopted this along with correlative rights), and Ohio); prior appropriation[57] (Kansas, Manitoba, North Dakota, and South Dakota); correlative rights[58] (Iowa); and restatement of torts[59] (Wisconsin).[60] Some jurisdictions by statute (the MGA region is not specifically addressed here) may prohibit injection of CO_2 into a saline formation without an explicit statutory exception.[61] For example, Nevada's permitting regulations, unless modified, would prohibit CO_2 injection into saline formations in part because the state has few water resources and these formations may hold future water resources that are currently uneconomic to access.[62] This issue has not been widely identified as a major barrier to

[55] Absolute ownership extends absolute rights to the surface estate to extract and utilize all groundwater underlying their property without regard to the impact to other users and without being held liable. This also applies the rule of capture in that the party that takes possession of a resource first becomes the owner. Under the rule of capture an owner that takes first possession can negatively impact the water resource of others without causing trespass.

[56] Reasonable use modifies the absolute ownership rule by limiting the ownership to reasonable use (used on-site and is not wasteful) of water resources and by recognizing the rights of other owners in the beneficial use of shared water resources.

[57] Prior appropriation gives water rights to those who are "first in use, first in time" priority over others. In states with prior appropriation there is often a statutory basis for how to establish priority and limit use to reasonable or beneficial uses.

[58] Correlative rights gives each overlying property owner correlative or co-equal rights to the reasonable, beneficial use of the basin supply of groundwater that is proportional to the size of their property, thus distributing water rights equally by ownership of overlying property

[59] Restatement of torts is a combination of the English and American rule giving the landowner the right to beneficial use of the groundwater as long as it does not impact the use of other owners in an unreasonable way that results in harm, such as not lowering the water table level.

[60] For detailed descriptions of these groundwater law frameworks, *see* USDA Forest Service, USDA Sourcebook of State Groundwater Laws in 2005, co-authored by Matthew Chapman and Stephen Glaser of the USDA Forest Service and Jack Gasman and Lois Witte with the USDA General Counsel (2005), *at* http://www.propertyrightsresearch.org/2006/articles07/usda_forest_service_sourcebook_o.htm. *See also* Water Systems Council, "Who Owns the Water?" a publication of Wellcare, *at* http://www.watersystemscouncil.org/VAiWebDocs/WSCDocs/1836033IN_WHO_OWNS.PDF.

[61] Mark A. de Figueiredo et. al, "Regulating Carbon Dioxide Capture and Storage" (2007), 6.

[62] Nevada Bureau of Mines and Geology, "Report 51: Preliminary Assessment of the Potential for Carbon Dioxide Disposal by Sequestration in Geological Settings in Nevada," *available at* http://www.nbmg.unr.edu/dox/r51.pdf.

storage in saline formations and has not been identified as an issue to date in the Midwestern context.

Natural gas storage as analogue for ownership issues

The IOGCC emphasizes that property rights need to be clearly delineated and paired with defined pathways for obtaining the necessary property rights for permitting, operating, and managing a geologic storage project.[63] The IOGCC approach to management of CO_2 storage is based on the ownership and protection of interests that exist in the subsurface pore space versus a water protection framework. The IOGCC examines relevant case law precedent to demonstrate the potential property interests in the subsurface pore space.[64] The IOGCC examined three analogues for geologic storage:

"(1) injection of CO_2 into underground formations for EOR;

(2) storage of natural gas in geologic reservoirs; and

(3) injecting acid gas into underground formations."[65]

The IOGCC concludes that natural gas storage is the most appropriate comparison, yet it acknowledges that there is a significant time difference between the comparatively short-term storage of natural gas and the long-term storage of CO_2. However, the IOGCC states that both natural gas storage and geologic storage involve the same set of legal interests. Several MGA jurisdictions have experience with natural gas storage and pipelines with regulation under the authority of different agencies.[66]

Compensation for resources in a formation

A potential limitation to the natural gas analogue is the degree to which resources that are present in a target formation for long-term storage may become economic in the future (e.g., residual oil or water resources). A mineral estate owner may claim that all of the minerals in a formation have not been completely depleted and require compensation. Marston and Moore provide an extensive analysis of the legal issues related to these resource interests and provide recommendations on how these issues may be addressed, particularly in the oil and gas context.[67] A similar situation may occur in a saline formation where the various interests in groundwater

[63] IOGCC (2007), 23.

[64] Ibid, 15-16.

[65] Ibid, 15.

[66] To review the different authorities regulating natural gas storage and pipelines in the MGA region, *See* the MGA Inventory (2009).

[67] Marston and Moore (2008): 472-487.

could claim that the formation was not yet depleted of potential water resources. In both cases, the owners of the interests in a formation may have a case for being compensated. The term 'depleted' will depend on several factors – including potential future uses of resources that either do not have current economic value or resources that cannot be extracted with current technologies.[68] Jurisdictions should identify and address the potential issues related to these existing or potentially economic resources (primarily oil and gas in the MGA region) in structuring ownership frameworks.

Hazardous waste case law as analogue for ownership issues

Hazardous waste case law reviewed by the IOGCC indicates through analogous precedent that subsurface trespass of CO_2 (e.g., migration beyond legally acquired bounds) would likely be a cause of action. These cases reviewed by the IOGCC take the approach that it is only when a surface owner is likely to use their subsurface property and the potential use has been taken away that trespass is a cause of action. In these cases, the plaintiffs (surface owners) were not able to demonstrate damages to their subsurface interests because they were not utilizing the subsurface.[69] The MGA Regulatory Inventory for Ohio outlines a case that addressed these issues in the 1996 Ohio Supreme Court Ruling on *Chance et al vs. BP Chemicals Inc*:

> "The Ohio Supreme Court ruled that there was no cause for assessing trespass damages as the land owners did not having a reasonable likelihood of using the saline Mt Simon Formation. The legal logic was the same as for trespass of airplanes above a property. If the surface owner has no reasonable expectation of use of the airspace then no damage has occurred and no damages needed to be awarded. This decision only applied to saline formations with no oil and gas potential."[70]

The IOGCC points out that geologic storage will be a "new legitimate use of the subsurface."[71]

Geologic storage as an activity in the public interest

Jurisdictions may prioritize and place value on the geologic storage of CO_2 by statutorily determining geologic storage as an activity that is in the public interest. The IOGCC concludes that, "GS [geologic storage] statutes and rules would best serve the public by clearly declaring that GS is an important activity for the public interest, clearly identifying the surface owner as the person with the right to lease pore space for storage, while protecting other stakeholders from

[68] EMNRD (2007), 15.
[69] IOGCC (2007), 22-23.
[70] MGA Inventory (2009): Ohio.
[71] IOGCC (2007), 22.

potential damage attributable to sequestration activities."[72] Defining geologic storage as an activity for the 'public interest' would leverage geologic storage projects in relation to other interests and likely extend state/provincial and federal mechanisms that have been applied to other projects deemed in the public interest (e.g., similar to the Natural Gas Act's eminent domain authority).[73] For example, legislation in North Dakota states:

> "It is in the public interest to promote the geologic storage of carbon dioxide. Doing so will benefit the state and the global environment by reducing greenhouse gas emissions. Doing so will help ensure the viability of the state's coal and power industries, to the economic benefit of North Dakota and its citizens."[74]

The implications of defining a geologic storage project as an activity in the public interest would likely extend to all areas of a geologic storage project with particular implications for the acquisition of land for infrastructure development (e.g., for CO_2 pipelines).

Trespass

Surface and subsurface trespass is a key issue that is impacted by the framework developed for property rights. Trespass is a significant issue because it is one of the most commonly cited potential sources of liability that would be a cause of action in a geologic storage project. Damage to or interference with property rights caused by a geologic storage project would potentially make an operator liable for a variety of claims including trespass.[75] Trespass may occur in a geologic storage project if the plume or associated pressure front adversely impacts surface or subsurface interests beyond the legally acquired bounds of the project. For example, a project's area of impact could move beyond the anticipated area where property rights were acquired and impact a mineral estate that had not been legally acquired in an adjacent property. Surface trespass could occur if the operations of a project damage the surface interests. The IOGCC examines analogous contexts for analyzing trespass issues through reviewing the rule of capture in the context of secondary oil and gas recovery in addition to trespass issues in the context of hazardous waste case law.[76]

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[72] IOGCC (2007), 23.

[73] *See* Congressional Research Service (CRS), report *RS22884*, "Delegation of the Federal Power of Eminent Domain to Nonfederal Entities," for a discussion of eminent domain applications, prepared by Robert Meltz, Legislative Attorney, American Law Division (May 2008).

[74] North Dakota Senate, S.B. 2095, 61st Legislative Assembly Session (2009).

[75] EMNRD (2007), 15.

[76] IOGCC (2007), 20 – 23.

The rule of capture

The rule of capture asserts that a property owner that first captures resources, such as oil and gas, may take those resources into their possession that exist in or migrate into a formation on their property. Under the rule of capture, one could theoretically drain resources in a shared formation from an adjacent property without being held liable. Conversely, the negative rule of capture would allow resources in a shared formation to move from one property into an adjoining property without causing trespass.[77] The cases reviewed by the IOGCC held that trespass would not be a cause of action in the EOR context because of the "fungible resources being produced" that were weighed against other interests.[78] Bruce M. Kramer and Owen L. Anderson, two prominent US oil, gas, and land use legal experts extensively discuss the case law history and application of the rule of capture in oil and gas operations. They also argue that the rule of capture may be applied against trespass claims in the oil and gas context because they are weighed against the value of oil and gas production for domestic energy security. Kramer and Anderson argue that other options (torts of negligence, nuisance, and waste) would be more appropriate to protect property owners where actual damage occurs.[79]

According to the New Mexico EMNRD analysis, the negative rule of capture is largely limited to supporting EOR but has been highlighted as an important legal issue to consider when examining a potential legal framework for geologic storage. The negative rule of capture could potentially be applied in a similar way to geologic storage using the justification of greenhouse gas reduction as a public benefit.[80] This application would limit the liability for injected CO2

[77] The IOGCC cites two cases from Texas to examine this issue in the context of oil recovery. In the first case, *RR Comm'n of Tex. V. Manziel*, the court held that trespass was not a cause of action based on the negative rule of capture. In the other case, *Mission Res., Inc. v. Garza Energy Trust*, an appellate court ruling held that subsurface trespass was a cause of action in the case of fracture treatment (or 'fracing' whereby a formation is fractured to increase permeability which can, in turn, increase fluid production). *See RR Comm'n of Tex. V. Manziel*, 361 S.W. 2d 560, 567 – 568 (Tex. 1962) and *Mission Res., Inc. v. Garza Energy Trust*, 166 S.W.3d 301, 310 (Tex. App.—Corpus Christi 2005, review granted, as cited in IOGCC (2007), 21.

[78] Ibid.

[79] Bruce M. Kramer and Owen L. Anderson, "The Rule of Capture, an Oil and Gas Perspective," *Environmental Law*, Vol. 35 (2005). Kramer and Anderson further cite, "Professors Laura H. Burney and Jacqueline L. Weaver have recognized these public policy arguments as implicit in the Supreme Court's withdrawal of its opinion in Geo Viking. Laura H. Burney, A Pragmatic Approach to Decision Making in the Next Era of Oil and Gas Jurisprudence, 16 J. Energy NAT. RESOURCES & ENVTL. L. 1, 39 (1996); Jacqueline Lang Weaver: The Politics of Oil and Gas Jurisprudence: The Eighty-Six Percent Factor: 33. WASHBURN L.J. 492, 524 (1994)."

[80] EMNRD (2007), 15.

that migrated beyond legally acquired bounds. There is uncertainty over how applicable this may be to geologic storage projects and if it would constitute a 'taking' of private property under the 5th Amendment of the U.S. Constitution.[81] Indeed, the IOGCC poses the question of how the public interest in greenhouse gas reduction through geologic storage would be weighed against private property rights.[82] Trespass has been limited previously based on the value of different activities and interests. Thus, the IOGCC concludes that geologic storage should be declared an activity of "high public importance" in a future regulatory framework to leverage the value of geologic storage.[83]

Private ownership v. public interest in resources

Case law shows that limitations to the mineral estate have been broadened to recognize the public value of resources. Previous cases constrained the mineral estate when damages were created through direct action and particularly when the action was performed in bad faith. Indiana case law most prominently illustrates this limitation on mineral rights in favor of protecting public resources through a case in which an operator was wasting natural gas. The Indiana Supreme Court held that excessively depleting the natural gas resources of Indiana negatively impacted the public. The Court stated that the constraints were to "…prevent, if possible, the exhaustion of the store house of nature, wherein is deposited an element that ministers more to the comfort, happiness and well-being of society than any other of the bounties."[84] Kramer and Anderson discuss how Indiana looked to the reasonable use doctrine of surface water law to "create a correlative rights component to the ownership of natural gas"[85] in *Manufacturers' Gas & Oil Co. v. Indiana Natural Gas & Oil Co* 58 N.E. 851 (Ind. 1900).[86] Further, a US Supreme Court opinion on *Ohio Oil Co. v State of Indiana,* 177 U.S. 190 (1900) held that:

> "[A]s to gas and oil, the surface proprietors within the gas field all have the right to reduce to possession the gas and oil beneath. They could not be absolutely deprived of this right which belongs to them without a taking of private property.

[81] EMNRD (2007), 15. The EMNRD states that the 5th Amendment "provides that no property shall be taken for public use without just compensation."

[82] IOGCC (2007), 21.

[83] Ibid.

[84] *State v. Ohio Oil Co*. 150 Ind. 21, 49 N.E. 809 (Ind. 1898), as cited in Kramer and Anderson (2005): 811–12.

[85] Kramer and Anderson (2005): 915 – 917.

[86] *57 N.E. 912* (Ind. 1900) as cited in Kramer and Anderson (2005). Kramer and Anderson further state that, "the Indiana Appellate Court reaffirmed correlative rights limited the common law rule of capture in *Richmond Natural Gas Co. v. Enterprise Natural Gas Co.* , 66 N.E. 782 (Ind. App. 1903)."

> But there is a co-equal right in them all to take from a common source of supply the two substances which in the nature of things are united, though separate . . . . [T]he use by one of his power to seek to convert a part of the common fund to actual possession may result in an undue proportion being attributed to one of the possessors of the right, to the detriment of the others, or by waste by one or more to the annihilation of the rights of the remainder."[87]

The US Supreme Court further stated that the rule of capture, applied with no constraints, would allow for one interest to deplete resources that are a commonly held interest in their entirety:

> "Hence it is that the legislative power . . . can be manifested for the purpose of protecting all the collective owners, by securing a just distribution, to arise from the enjoyment, by them, of their privilege to reduce to possession, and to reach the like end by preventing waste."[88]

Acquisition of property rights

A significant number of property interests may need to be acquired since case law is not definitive regarding how property interests will be balanced. In the situation where the surface owner does have ownership of the pore space (and resources are depleted) there will need to be appropriate mechanisms to obtain rights or permission to utilize the storage space from the surface owner. The rights or permission of the surface owner and the owner of any existing severed/separate resource (e.g., the mineral estate) must be acquired or leased in cases where the formation still holds resources.[89] Indeed, project developers may find it advantageous to acquire both sets of rights in order to provide a greater level of certainty and to decrease risk. Lawrence Bengal, speaking as chair of the IOGCC, stated in Senate testimony in July 2008 that it may be "prudent" to obtain both the surface and mineral rights within a project. The IOGCC acknowledges that this may be a significant level of investment for project developers but that the prudence lies in the prevention of litigation and the knowledge of all interests within a project boundary.[90] The prudence of this approach is supported by other analysis that indicates the

[87] *Ohio Oil Co. v State of Indiana,* 177 U.S. 190 (1900), 209 – 10.
[88] *Ohio Oil Co. v State of Indiana,* 177 U.S. 190 (1900), 209 – 10.
[89] De Figueiredo, "Property Interests and Liability of Geologic CO_2 Storage" (2007), 246.
[90] Testimony of Lawrence E. Bengal, Director, Arkansas Oil and Gas Commission and Chairman of the Interstate Oil and Gas Compact Commission Task Force on Carbon Capture and Geologic Storage, Hearing to receive testimony on carbon capture, transportation, and sequestration and to receive testimony on two related bills, United States House of Representatives, Committee on Energy and Commerce, Subcommittee on Environment and Hazardous Materials (July 24th, 2008), *available at* http://energycommerce.house.gov/cmte_mtgs/110-ehm-hrg.072408.Bengal-testimony.pdf. *See also* a discussion of the implications of the multiple interests in property in Wilson and De Figueiredo (2006).

likely significance of both the surface and mineral estate in many potential formations suitable for geologic storage.[91]

Property rights may be obtained through negotiation or through involuntary mechanisms allowed under state and provincial law. Examples of mechanisms to acquire storage rights include:

1) negotiation through lease or deed with the property owner(s);[92]
2) an easement for the storage space,
3) determination that the pore space is in the public domain;
4) voluntary/compulsory unitization of the delineated area (oil and gas analogue); or
5) condemnation through eminent domain (natural gas analogue).[93]

Looking to the analogy of natural gas storage, an operator would have to provide just compensation to a surface owner to utilize the storage space. The MGA Inventory for Illinois provides a description of the property rights acquisition and compensation process for the geologic storage component of the FutureGen Illinois project:

> "For the long-term, 30 MT plume, storage deed options were negotiated for as little as $5 per acre with the surface owners. Resolutions were approved by local government agencies to offer fence row-to-fence row access to public rights of way covering the entire plume area to backstop monitoring on developer-controlled land."

The MGA Regulatory Inventory for Ohio details a 1992 Ohio Supreme Court (OSC) Ruling that addressed issues of just compensation under Ohio law in the context of natural gas storage:

> "Columbia Gas Transmission Corp. vs. Exclusive Natural Gas Storage Easement in the Clinton Subterranean geological formation et al. This was an opinion given by the OSC to the following question posed by the US District Court, Northern District of Ohio: "According to the law of the state of Ohio, what is the measure of just compensation for the appropriation of an underground storage easement?" Six methods for determining compensation were considered and covered in the opinion. One was the "View point of value" which looks at what the landowner has lost, not what the injector has gained. If there is no impact on the surface owner's property value due to no reasonable expectation of use of the formation, then no compensation is due. Other methods assume some use is present and may apply when conflicting injectors are looking to use the saline formation within each other's area of review."[94]

[91] Duncan et al. (2008); Wilson and de Figueiredo (2006).
[92] De Figueiredo, "Property Interests and Liability of Geologic CO_2 Storage" (2007), 247.
[93] IOGCC (2007), 28 – 29.
[94] MGA Inventory (2009): Ohio.

Some have suggested the creation of an institutional body at the jurisdictional level to mediate the process for acquisition of pore space rights and to provide a process for property interest owners to collectively negotiate for compensation through an experienced representative. This could reduce the potential for numerous negotiations, clarify the process of property acquisition for both project developers and property interest owners, and provide a centralized place to gather information related to property interests involved in a project. For example, Manitoba has a Surface Rights Board that "arbitrates disputes and provides mediation services between surface owners, occupants and oil and gas rights holders on a voluntary basis."[95]

The IOGCC outlines mechanisms to acquire the necessary rights for geologic storage in their Model Rules and Regulations. They envision options such as the application of eminent domain or modified oil and gas unitization statutes to acquire the necessary rights. They outline a process to integrate and streamline the acquisition of property rights and site licensing through combined hearings as each activity may be under a different authority.[96] The IOGCC acknowledges that other mechanisms may be used in some jurisdictions and stress that it is more important to acquire all necessary property rights "by valid, subsisting, and applicable state law" than by any particular mechanism.[97]

Conclusion

A clearly designated authority and pathway for the acquisition of property rights will facilitate project development and prevent project delays in areas where there are numerous interests involved. States and provinces that have the potential to develop geologic storage projects need to address and clarify the surface and subsurface interests that are involved. Project operators and owners will need to consider the potential impact to the different interests within a geologic storage project boundary and the potential impact to the interests in adjacent properties as the CO_2 plume, associated pressure front, and any displaced brine migrate through the subsurface or through impacts from site characterization and/or project operations and management. States and provinces may provide more certainty for project developers and those with ownership interests in a geologic storage project through legislation.

[95] MGA Inventory (2009): Manitoba.
[96] Ibid, 28 – 29.
[97] Ibid, 29.

LIABILITY & FINANCIAL RESPONSIBILITY FOR LONG-TERM SITE STEWARDSHIP

This section addresses the issues at the state and provincial level related to managing liability and financial responsibility for stewardship of a geologic storage site over the long term. Geologic storage project owners and operators will be responsible for their projects within a broad range of statutory, regulatory, and contractual requirements. Geologic storage sites will be managed over a significant period of time after operations cease and requirements for site closure have been met. Site operations will likely be managed through contracts similar to those of oil and gas operations that inject CO_2, while new approaches will be needed for managing the financial risk and liabilities over the long-term of a geologic storage project.

MENU OF ACTIONS

This menu of actions provides potential options that may be adapted and applied to meet specific needs of different jurisdictions.

1. Develop a liability and financial responsibility framework to manage geologic storage projects:
   a. Evaluate recommended frameworks for ensuring financial responsibility and managing liability for CCS projects. This evaluation should take into account the lessons learned and strengths of frameworks from previous and existing analogous frameworks.

2. Development of a Geologic Storage Utility:
   a. Recommend the development of a Geologic Storage Utility to manage geologic carbon storage. Primary functions would include:
      1. "Develop, operate and manage all geologic CO_2 storage sites within a jurisdiction, except for those sites with additional commercial value (e.g. EOR);
      2. Build and operate CO_2 pipelines; and
      3. Recover operational expenses through regulated rate recovery." *See Appendix B for complete draft discussion paper, Conceptual Geologic Storage Utility, prepared by CATF* (2008).
   b. Draft state and federal legislation that would enable the development such a Geologic Storage Utility.

3. State/provincial/federal coordination:
   a. Work with state/provincial/federal stakeholders in moving forward on a liability and financial responsibility framework in order to support project development and accelerate the safe and rational deployment of CCS in a manner consistent with MGA Platform goals.

4. Identify potential barriers for development of liability frameworks.
   a. For example, the state of Michigan would not be eligible to take responsibility for liability according to the Michigan constitution.

Background

Project developers and operators in the oil and gas industry have managed the risks of CO_2 injection and incidental storage[98] for hydrocarbon recovery for decades. The injection of CO_2 for the purpose of geologic storage will require mechanisms that address the long-term nature of the potential risks and associated costs. Long-term liability issues were identified by project developers interviewed by MGA staff as one of the main factors creating uncertainty around the potential risks and costs of geologic storage projects.[99] The uncertainty related to liability issues makes it difficult for project developers to acquire financing for projects. Advanced coal with CCS project costs are already at an elevated level where added financial risks from open-ended liability create barriers to project financing and development.

Liability is managed in other industries in the United States and Canada through many different mechanisms and entities that provide instructive models for developing a long-term stewardship framework. The financial and/or insurance industry will be able to quantify risks and costs in their evaluation of each geologic storage project based on several factors. Regulators will need to verify that potential costs of a project will be covered by the financial responsibility framework in place for each project.[100] The public will assess potential projects, regulations in place, and will evaluate the risks and benefits to their local and global community. Policymakers will develop a framework that balances the different interests and entities involved with and affected by CCS projects. The framework in place will have to address these interests and provide a strategy that both supports project development and provides for regulation that ensures public and environmental safety and welfare.

Mechanisms to manage liability effectively will have to ensure that geologic storage projects are sited, operated, and managed safely through each phase of a project. Mechanisms should also be structured in a way that does not preclude investment in CCS projects (e.g., by creating

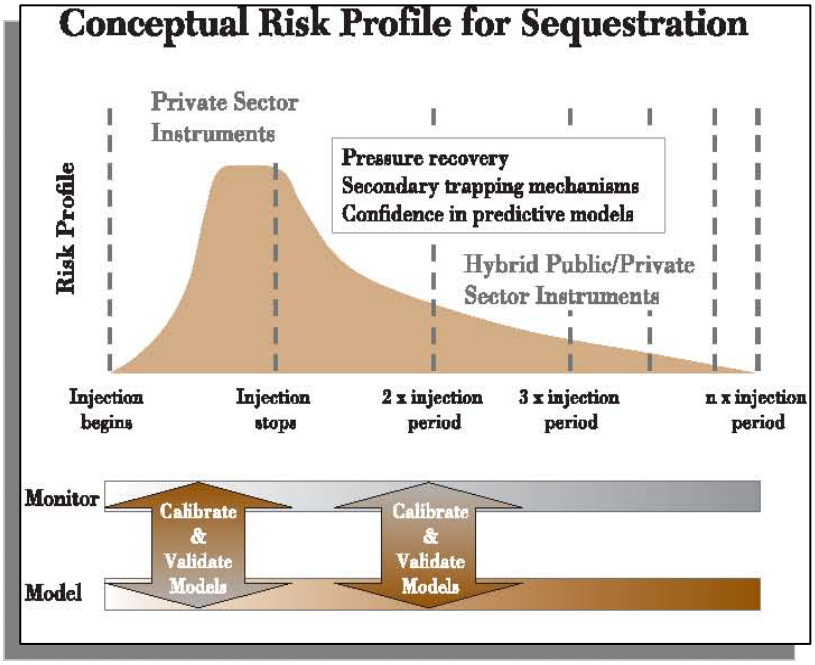
[98] The carbon dioxide that remains in the reservoir after being used in enhanced oil recovery operations. *See* the Department of Energy's CO_2 Enhanced Oil Recovery Fact Sheet *at* http://fossil.energy.gov/programs/reserves/npr/CO2_EOR_Fact_Sheet.pdf.

[99] Midwestern Governors Association (MGA), "Project Developer Interviews," prepared by Jennifer Johnson, Great Plains Institute, for the MGA Renewable Electricity and Advanced Coal with Carbon Capture Advisory Group (2008).

[100] Chiara Trabucchi and Lindene Patton, "Storing Carbon: Options for Liability Risk Management, Financial Responsibility," *Daily Environment Report*, Vol. 2008, No.170, the Bureau of National Affairs, Inc (3 September 2008): 2.

prohibitive costs or levels of risk). Mechanisms for managing site risks and the attendant liability and financial responsibility should provide incentives for the project owner or operator to ensure that projects are sited, operated, and managed safely and economically starting at the critical early stages of projects.[101] Such mechanisms will likely provide a greater degree of public confidence (in addition to other factors such as education, transparency, etc. that are not addressed here) to support geologic storage projects and will provide project developers a more defined path for moving CCS technologies forward.

Figure 1



Source: WRI Issue Brief on Liability and Financial Responsibility Frameworks for CCS (based on Sally Benson, Stanford University).

The costs of managing a geologic storage project will cover different phases of the project over time, from capture and transport to injection operations that are followed by monitoring, mitigation, and verification activities (MMV). These costs also must cover any potential risk for short or long-term liability arising from leakage, migration of the CO_2 beyond the legally defined project boundary, or other potential adverse impacts of CO_2 injection and storage.

Entities beyond the initial project operator may take responsibility for some phases of the project chain – particularly for long-term management and assumption of long-term liability. As illustrated in Figure 1, the risks of events that could trigger liability should likely reduce over time. This graphic depicts how a well selected and characterized site should reduce risk after the initial project phase with the risk 'tail' becoming smaller over time. This is supported by expert analysis in the "Special Report on Carbon Dioxide Capture and Storage" released by the Intergovernmental Panel on Climate Change (IPCC) in 2005. Beginning stages of a project are

[101] Ibid.

critical to reducing the risk potential over the long-term. Key actions at the beginning of a geologic storage project include the selection of an appropriate site and site characterization to determine the site's suitability for CO_2 injection and storage.[102] Any liability framework should provide incentives from the outset of a project to reduce the potential risks over the long term.

Types of liability

Geologic storage projects may be subject to liability under common law, contractual requirements, and jurisdictional and federal statutes (e.g., the Underground Injection Control (UIC) program under the Safe Drinking Water Act – SDWA, Resource Conservation and Recovery Act – RCRA, and Comprehensive Environmental Response, Compensation, and Liability Act – CERCLA). Geologic storage projects may be subject to tortious liability that would stem from a project adversely impacting other interests and would be brought under four different common law doctrines: nuisance, trespass (discussed in the ownership issues section), strict liability, or negligence. Contractual liability would stem from an operator or other responsible entity breaching contractual obligations (e.g., failure to contain CO_2 after receiving carbon credits for containment). Mark A. de Figueiredo provides a detailed discussion in his widely cited 2007 MIT thesis on the different pathways that could be taken for these liabilities to be actionable and in which potential contexts they could apply to geologic storage.[103]

De Figueiredo conducted a survey of non-governmental organizations (NGOs) and industry stakeholders to identify the primary potential sources of liability. Based on these results, de Figueiredo analyzes four identified risks and their implications for liability: induced seismicity, groundwater contamination, harm to human health and the environment, and property interests.[104]

- Induced seismicity: the limited potential for induced seismicity could arise from either site operations on the surface or the movement of CO_2 in the subsurface. There have been no cases to date related to CO_2 injection activities in the U.S. where induced seismicity was proven to be a valid cause of action for liability.
- Groundwater contamination: this is largely governed by state and provincial groundwater frameworks that determine who has standing to bring causes of action. The plaintiff would

[102] For a detailed discussion and recommended guidelines on site selection and characterization, *See* WRI's CCS Guidelines (2008), 83-92.

[103] *See* De Figueiredo, "The Liability of Carbon Dioxide Storage" (2007), 55-61

[104] Ibid, 153-191.

be required to prove that the contamination and harm was caused directly by actions of the defendant. Beyond state law and private causes of action in the US, the federal EPA UIC Program has penalties for violations under the SDWA.

- Harm to human health: this would likely have to be proven first through demonstrating that CO_2 exposure can in fact cause harm in the given context and subsequently by proving that the facts in the present case prove that CO_2 exposure occurred, did cause harm, and was a result of the defendant's activities.[105]

These potential sources of liability should not pose a significant risk in sites with proper site selection, characterization, operation, closure, and management. The IPCC stated that "the fraction [of carbon dioxide] retained in appropriately selected and managed geological reservoirs is very likely to exceed 99 percent over 100 years and is likely to exceed 99 percent over 1,000 years."[106]

Carbon Dioxide Classification: Waste or Commodity

One of the major questions regarding CO_2 management centers on whether CO_2 is classified as a waste or as a commodity under the authority of the EPA UIC program. This has implications on several levels and different parties have argued for both classifications. The EPA stated in the July 2008 EPA UIC proposed rule for Class VI wells[107] that it was beyond their scope to determine if CO_2 had value as a commodity in the marketplace.[108] In addition, the EPA's proposed rule defined a CO_2 stream to exclude hazardous wastes, stating that Class VI applies to projects with a CO_2 stream falling within their definition, precluding the injection of hazardous wastes into Class VI wells.[109] The EPA did clarify in the preamble to the rule that although CO_2 is not defined as a commodity or waste in this context that geologic storage projects may trigger federal law such as CERCLA (or Superfund)[110] or RCRA[111] depending on the composition of the

[105] De Figueiredo, "The Liability of Carbon Dioxide Storage", (2007), 153-191; *See* MGA Inventory (2009) for state treatment of water rights within the MGA region.

[106] Intergovernmental Panel on Climate Change (IPCC) (2005), 13. The IPCC defined "very likely" to be a probability from 66 and 90 percent and "likely" to be a probability from 90 to 99 percent.

[107] Class VI is the proposed well class in the EPA UIC program for storage of carbon dioxide. *See* Appendix D for further discussion of key components of the proposed Class VI requirements.

[108] *See 73 FR 43496* for further discussion by the EPA on the waste v. commodity issue.

[109] Hazardous wastes as defined in draft *40 CFR part 261.*

[110] Comprehensive Environmental Response, Compensation, Liability Act (CERCLA). *See* the EPA's Overview on CERCLA, *available at* http://www.epa.gov/superfund/policy/cercla.htm.

[111] Resource Conservation and Recovery Act (RCRA). *See* the EPA's Laws and Regulations for RCRA and background information, *available at* http://www.epa.gov/epawaste/laws-regs/index.htm.

CO_2 stream.[112] Thus, absent legislation or further regulatory definition, geologic storage projects could trigger these federal statutes depending on the co-constituents in the CO_2 stream. This possibility is widely viewed from a project developer perspective to be a major barrier.

Mechanisms to address financial responsibility and liability

Significant analysis has been completed on different approaches and frameworks for addressing liability in the context of CCS. Most have suggested that the public sector will likely be the most appropriate candidate for taking on long-term liability and for long-term management of a geologic storage project. The commonly identified strength of the public sector is that governmental institutions, such as state, provincial, and national governments, are much more likely to remain intact and have the capacity to manage a geologic storage project over time while entities in the private sector may be outlived by the management timeframe of a geologic storage project.

Several existing frameworks for financial responsibility and management of liability have been evaluated in many publications that provide valuable insight on the strengths and weaknesses of previous and/or existing mechanisms. There is a wealth of experience from other industries that can provide important lessons and provide tested mechanisms. New strategies have been proposed, with the knowledge of previous frameworks, for the development of mechanisms to manage liability and to provide financial assurance that operators or other parties will be accountable for meeting state/provincial/federal requirements of siting, developing, operating and managing geologic storage sites over the long-term. Some of the frameworks to address long-term liability that have been most prominently evaluated by several experts include:

1) RCRA;
2) CERCLA;
3) Price-Anderson Nuclear Industries Indemnity Act;
4) National Flood Insurance Act;
5) Orphan Well Program;[113]
6) Trans-Alaska Pipeline Authorization Act of 1973;
7) Oil Pollution Act of 1990; and
8) National Vaccine Injury Compensation Program.[114]

[112] The Supreme Court determined in *Massachusetts v. Environmental Protection Agency*, 549 U.S. 497 (2007) that the EPA has statutory authority to regulate CO_2, in addition to other greenhouse gases, under the Clean Air Act and must determine action or inaction on the issue according to the statute. *Available at* http://www.supremecourtus.gov/opinions/06pdf/05-1120.pdf.

[113] *See* the MGA Inventory (2009) for states that have orphan well programs to manage and remediate wells when the responsible entity cannot be identified.

Potential Frameworks

Recommendations and/or legislation have been developed by several parties (e.g., the IOGCC, CATF, WRI, and Trabucchi and Patton) and jurisdictions (Kansas, North Dakota, FutureGen legislation in Texas and Illinois) on potential frameworks. This section will highlight some of the approaches for design and implementation of financial responsibility and liability frameworks.

Interstate Oil and Gas Compact Commission (IOGCC)

The IOGCC determined after its review of existing frameworks that a modified version of existing frameworks could be developed by states and provinces. This program would designate the state/province as the administrator or "caretaker" of an industry-funded trust fund to manage a site during the Post-Closure Phase. The trust fund program would collect funds through an injection-fee on a per ton basis. The IOGCC acknowledged the range of potential strategies for site management and did not recommend against the potential development of other mechanisms. The IOGCC further acknowledged that jurisdictions would develop their own MMV regulations, thus the IOGCC did not develop model rules and regulations in this area. The IOGCC does detail specific elements that the designated State Regulatory Agency (SRA) should consider including in a monitoring program.[115]

Geologic Storage Utility

The Clean Air Task Force developed a draft discussion paper, presented at an October 2008 MGA meeting, on creating a public utility that could provide basin-wide[116] management of geologic storage projects. This utility would be regulated by jurisdictional regulatory commissions and would "be responsible for reliably receiving and distributing CO_2 to geologic storage sites, which it would also manage in perpetuity." The utility would primarily:

1. "Develop, operate and manage all geologic CO_2 storage sites within a jurisdiction, except for those sites with additional commercial value (e.g. EOR);
2. Build and operate CO_2 pipelines; and
3. Recover operational expenses through regulated rate recovery."[117]

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[114] For analysis of these programs, *see* IOGCC (2007); EMNRD (1 December 2007); De Figueiredo, "The Liability of Carbon Dioxide Storage" (2007); and Trabucchi and Patton (2008).

[115] IOGCC (2007), 31.

[116] A geologic basin may contain areas that are hydraulically connected and may have the capacity to store CO_2 from multiple projects.

[117] Clean Air Task Force (CATF), "Draft Conceptual Geologic Storage Utility," presented to the Midwestern Governor's Association Renewable Electricity and Advanced Coal with Carbon Capture Advisory Group (1 October 2008). *See* Appendix B for the complete draft paper.

This conceptual framework would address cross-boundary issues of multiple projects operating and impacting others in a shared basin and address the issues of long-term management. This could also potentially incentivize strategic site selection as the same entity responsible for distributing the CO_2 among suitable sites would also be responsible for long-term management.

Financial Risk Management Framework

Chiara Trabucchi and Lindene Patton, experts in financial assurance and financial indemnity models, have developed a "Recommended Financial Risk Management Framework" that was presented in September 2008 at an Indiana CCS Summit.[118] This Framework focuses on the national level but similar elements and mechanisms could theoretically be developed at a state, provincial or basin-wide level (e.g., to ensure comprehensive management of basins shared by separate and neighboring jurisdictions). The primary components of this framework include:

1. "A CCS Safety Board – Design Goal: Ensure siting/operating decisions that consider risk and minimize the potential for residual injury at the time of CCS site transfer."
2. "A CCS National Trust – Design Goal: Ensure availability of funds to pay for future (un) expected costs of long-term care and delimited compensatory damages."
3. "A list of enabling legislation beyond the CCSB and CCS National Trust, including to: Establish Liability Provisions; Identify Damages Thresholds; Require Evidence of Financial Responsibility; Provide for CCSSB Oversight Authority; Allow for State Access to Funds in the CCS National Trust; and to Address Miscellaneous Receipts Act Issues."[119]

In addition to providing a recommended financial responsibility framework, Trabucchi and Patton also provide a detailed discussion of the issues that should be addressed and the underlying structure of developing a financial risk framework in the context of CCS. Their expert analysis and discussion provide a detailed and instructive background on the fundamental issues that should be addressed in a risk management framework.

World Resources Institute (WRI): CCS Guidelines

The World Resources Institute has developed a set of recommendations and guiding principles for managing CCS projects that have been developed with the input of over 80 stakeholders (from academia, business, government, and NGOs, including several stakeholders in the MGA process or their organization). The process culminated in a comprehensive guidance document for understanding the complex issues related to CCS.

[118] Trabucchi and Patton (2008). Also s*ee* Indiana Carbon Capture and Sequestration Summit, *available at* http://www.in.gov/oed/2573.htm.

[119] *See* Appendix C for the full Summary table from Trabucchi and Patton (2008).

The CCS Guidelines[120] document includes a set of Recommended Guidelines for Financial Responsibility (see Text Box 1 below).

Text Box 1: Excerpt from the WRI CCS Guidelines

"World Resources Institute: Recommended Guidelines for Financial Responsibility:

a. Based on site-specific risk assessment, project operators/owners should provide an expected value of the estimated costs of site closure (including well plugging and abandonment, MMV, and foreseeable mitigation (remediation) action) as part of their permit application. These cost estimates should be updated as needed prior to undertaking site closure.

b. Project operators/owners should demonstrate financial assurance for all of the activities required for site closure.

c. Policies should be developed for adequately funding the post-closure activities that become the responsibility of an entity assuming responsibility for long-term stewardship, as described in the Post-Closure section.

d. Because of the public good benefits of early storage projects and the potential difficulty of attracting investment, policymakers should carefully evaluate options for the design and application of a risk management framework for such projects. This framework should appropriately balance relevant policy considerations, including the need for financial assurances, without imposing excessive barriers to the design and deployment of CCS technology."

[120] *See* Appendix F for the WRI CCS Guidelines Executive Summary.

Time frame: Long-term liability and risk management

Geologic storage projects will likely be managed over a long time period and, as discussed earlier, many have recommended that the ownership and long-term stewardship of a geologic storage site would eventually be transferred to a government entity. Frameworks that recommend the transfer of ownership to a government entity likely designate certain performance standards and/or a temporal requirement that must be met before a transfer takes place. The requirement of a time period has been used in other frameworks (e.g., the EPA UIC program) but has been a focal point of discussion by experts as to whether it is appropriate and necessary from the standpoint of risk management and site stewardship. Project owners and operators may be concerned that a default time frame applied to all projects will be difficult to reduce from a public acceptance viewpoint even if the project meets the requirements for reduction on a technical basis (as provided for in the EPA proposed rule).[121] A clear, plausible pathway for reducing the time frame will be important for the framework to incentivize project operators and owners to actively develop and manage the project at the outset in a way that decreases risk over time. A lack of a clear pathway for reducing the time period could create a disincentive for geologic storage project owners and operators to provide safe and effective management.

IOGCC Recommendation

The IOGCC recommends that 10 years after site closure, or a time period otherwise designated by the State Regulatory Agency, the responsibility should be transferred to a public entity. This is contingent upon monitoring during the operational period to verify site integrity before transfer.[122] The process for closure and transfer to the governmental entity is as follows in Section 9.0(j) Closure, of the IOGCC General Rules and Regulations:

> "At the conclusion of the CSP [CO_2 Storage Project] closure period, the CSP performance bond maintained by the CSP operator shall be released, and continued monitoring of the site, remediation of any well leakage, including wells previously plugged and abandoned by the CSP operator, shall become the responsibility of designated state or federal agency programs and the CSP operator and generator of the CO_2 shall be released from further SRA regulatory liability related to the CF [CO_2 Facility]."[123]

[121] Draft US EPA UIC Rule (2008), *40 CFR § 146.93.*
[122] *See* IOGCC (2007) for the definition and requirements of the Closure Period, 40.
[123] Ibid, 49.

US EPA proposed rule

The EPA states in the proposed Class VI rule that the site operator maintain monitoring of the site for a period of 50 years from the point when injection ceases. This period of time may be decreased at the Director's discretion if site integrity is demonstrated to the extent that the project does not pose a threat of endangerment to underground sources of drinking water (USDWs).[124] The EPA acknowledges that they have reviewed the IOGCC proposal for post-injection site care in addition to other environmental programs (citing that the UIC program uses 30 years in other cases). However, the EPA's view is that the 10-year time frame proposed by the IOGCC would not be sufficient in situations in "which the potential risks of endangering USDWs will not decline within that timeframe given that stabilization [of the CO_2 plume and associated pressure front] may continue for several decades."[125] The EPA further explains in the Preamble to the draft rule:

> "Also, a 30-year timeframe can be appropriate for the types of fluids typically injected under the UIC Program (i.e., fluids that are liquids at standard pressure and temperature). Longer timeframes may be more appropriate for GS wells, because the fluid is likely to be stored in a supercritical phase, the plume for a full-scale GS project will likely be large, and substantial pressure increases will likely be observed during operation. However, once injection ceases, pressure will likely begin to dissipate and 30 years may be enough time for the plume and pressure front to stabilize." (73 FR 43519)

Under the proposed rule, an application may be made to decrease the time period for post-injection monitoring, "If the owner or operator can demonstrate" the stabilization as required in the rule before 50 years, the Director may approve an amendment to the plan to "reduce the frequency of monitoring or may authorize site closure before the end of the 50-year period."[126]

Conclusion

Several potential strategies and frameworks are beginning to emerge from state legislatures, stakeholder groups, and potentially at the federal level to shape how the issues of long-term liability and financial responsibility will ultimately be addressed. It will be important to design a framework that ensures safe, effective, and economic project siting, operations, management and to provide for the involvement of all stakeholders and constituencies.

[124] Draft US EPA UIC Rule (2008), *40 CFR § 146.93*.
[125] Ibid, *73 FR 43519*.
[126] Ibid, *40 CFR § 146.93*.

SUPPLEMENTARY MATERIAL

ACRONYMS & ABBREVIATIONS

- CO_2: Carbon dioxide
- CCS: Carbon capture and storage
- CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act
- CATF: Clean Air Task Force
- CRS: Congressional Research Service
- DOT: Department of Transportation
- EMNRD: New Mexico's Energy, Minerals, and Natural Resources Department
- EOR: Enhanced oil recovery
- EPA: Environmental Protection Agency
- FERC: Federal Energy Regulatory Commission
- GAO: Government Accountability Office
- GS: Geologic storage
- IOGCC: Interstate Oil and Gas Compact Commission
- ICC: Interstate Commerce Commission
- ICCTA: Interstate Commerce Commission Termination Act
- IPCC: Intergovernmental Panel on Climate Change
- MGA: Midwestern Governors Association
- MMV: Monitoring, mitigation, and verification (of a geologic storage project)
- MRCSP: Midwest Regional Carbon Sequestration Partnership
- NGO: Non-governmental organization
- OPS: Office of Pipeline Safety
- PHMSA: Pipeline and Hazardous Materials Safety Administration
- RCRA: Resource Conservation and Recovery Act
- SDWA: Safe Drinking Water Act
- SRA: IOGCC term for a State Regulatory Agency
- STB: Surface Transportation Board
- UIC: Underground Injection Control (EPA program)
- USDW: Underground Source of Drinking Water

APPENDIX A - IOGCC REGULATORY GUIDE

INTERSTATE OIL AND GAS COMPACT COMMISSION:

Legal and Regulatory Guide for States and Provinces

Summary reprinted with permission from American Electric Power, "AEP Draft State Clean Energy Development Concept Bill and Toolkit," prepared by Paul Loeffelman (June 10th, 2008).[1]

Carbon Capture and Storage

The Interstate Oil and Gas Compact Commissions (IOGCC), with sponsorship from the U.S. Department of Energy, established a "Geological CO_2 Sequestration Task Force" (the Task Force) to examine the technological, policy and regulatory issues related to the safe and effective storage of CO_2. The culmination of a two-phase, five-year effort is a model legal and regulatory framework for the storage of CO_2 in geologic media for states contemplating going down this path. The following provides a summary of this framework.

- Property Rights - The program should establish clear rules about how property rights will be recognized and protected in conjunction with CO_2 storage projects. Surface owners are identified as the person with the right to lease pore space for storage. All necessary property rights are acquired by valid, subsisting and applicable state law such as eminent domain and unitization of oil and gas rights. Alternative mechanisms to acquire property rights, such as adapting the concept of the forced unitization of oil and gas industry rights to other property interests may be explored by some states. An applicant must demonstrate that a good-faith effort has been made to obtain the consent of a majority of owners "having property interest affected by the storage facility." The program provides for an applicant to have the power of eminent domain and provides that an applicant will be deemed to have necessary property rights to the extent that the applicant has initiated unitization or eminent domain proceedings and have thereby gained the right of access to the property.
- Experimental Projects - In advance of state adoption of its model rules, it may be necessary to permit and operate experimental and demonstration CO_2 sequestration projects. The model program recommends that states adopt those projects under existing authority rather than to await adoption of this model program.
- Commodity vs. Waste - The model statute describes carbon dioxide as a valuable commodity and sets the stage for the regulation of the storage of carbon dioxide as a non-waste. This concept is not only important to the development of the regulatory program, but also to public perception about the presence of CO_2 being stored under their property.
- Covered Facilities - The definition of "storage facility" includes the reservoir, wells and related surface facilities but apparently not pipelines used to transport carbon dioxide from capture facilities to the storage and injection site.
- Trust Fund - The program establishes a trust fund which would assess a fee on each ton of CO_2 injected. It could be used "solely" for long term monitoring of the site. The trust fund provides the financial resources for the state to take title to project at the end of its operating life.

[1] The complete toolkit, including a State Clean Energy Development Concept Bill and periodically updated state activities is *available at* http://www.aep.com/environmental/positions.

- User Fee - A separate fund and fee is authorized for the sole purpose of funding the administration and enforcement of the regulatory program.
- Liability Release - Following completion of the project an operator would be obligated to monitor the project to assure its integrity. At the completion of that period the operator and all generators of CO_2 injected would be released for all regulatory liability and any posted performance bonds would also be released. The model program does not address releasing liability from common law tort liability.
- Cooperative Agreements - Cooperative agreements are authorized for use in connection with projects that extend beyond state boundaries.
- EOR Projects - Enhanced Oil Recovery projects are not covered by the model program, although agencies are encouraged to develop rules on how enhanced recovery operations would be converted to carbon dioxide storage projects.
- Right of Access - Agencies are authorized to have a right of access to storage operations for purposes of determining whether performance is being conducted in accordance with the regulatory requirements.
- Permit Transfer - Permit transfer is authorized; however, an operator shall not be relieved of responsibility until the agency acknowledges the sale, assignment, transfer, conveyance, exchange or disposition in writing and the person or entity acquiring the facility is in compliance with all appropriate requirements.
- Permit Requirements - The program provides detailed requirements for completing an application for approval of a CCS project. Among other things maps accompanying a permit application would be required to identify existing oil and gas and coal mining operations. Public notice is completed upon mailing. A notice filed in conjunction with a permit application must include the date, time and place of the hearing before the agency, although it is not clear how an operator would know of the details of that hearing in advance of the filing of a permit application. The agency shall issue a permit to drill and operate once it has completed a review of the application. The permit would expire within twelve months from the date of issuance if the permitted well had not been drilled or converted. The program also sets forth detailed well operational standards, including requirements for safety plans, leak detection, and corrosion monitoring and prevention. Detailed reporting requirements are also established.

APPENDIX B – CREATION OF A GEOLOGIC STORAGE UTILITY

Note: This discussion draft was presented at the MGA Advanced Coal with Carbon Capture and Storage sub-group meeting on October 1st, 2008 in Columbus, Ohio.

DISCUSSION DRAFT ONLY

Conceptual Geologic Storage Utility

Sketched below is a concept shared by the Clean Air Task Force for MGA Advisory Group discussion. The proposal is for managing geologic carbon storage through a public utility regulated by state/provincial utility regulatory commissions and operating on a geologic basin-wide basis. As with an entity like an electric distribution utility, this utility would be responsible for reliably receiving and distributing CO_2 to geologic storage sites, which it would also manage in perpetuity. For these services, the utility would recover its cost in rates, along with a reasonable rate of return. The value of creating a public utility would be to create certainty and reliability in developing geologic storage at a system-wide scale. It is not intended to compete with otherwise commercial operations, such as enhanced oil recovery (EOR).

The MGA could consider recommending the development of such utilities at the jurisdictional level, and the adoption of any necessary enabling legislation at the federal level. In addition, the MGA could develop draft state and federal legislation and rules that would enable the development of such an entity.

What:

Create a new, public utility whose primary functions are to:

1. Develop, operate and manage all geologic CO_2 storage sites within a jurisdiction, except for those sites with additional commercial value (e.g. EOR);
2. Build and operate CO_2 pipelines; and
3. Recover operational expenses through regulated rate recovery.

Why:

A new utility could:

- Create certainty by offering a known CO_2 storage option;
- Create an entity that can identify and implement an on-going CO_2 storage plan for jurisdictions in a geologic basin;
- Ensure reliable access to an infrastructure and skilled workforce capable of managing CO_2 storage;
- Free existing utilities and industries from the task of becoming experts in a completely new activity outside their core business (i.e. characterizing, permitting, developing, monitoring, and maintaining geologic sites and pipelines needed for safely storing CO_2);
- Resolve the question of long-term liability by retaining both the management of and liability from project siting in perpetuity;
- Significantly reduce the complexity of managing multiple projects, acquiring property rights, and addressing property damage and other liability issues; and
- Facilitate storage resource development through exploration and managing storage demonstration projects.

Utility Powers and Responsibilities:

- Recover, through regulatory commission proceedings, funds from consumers jurisdiction-wide to accomplish the goals of this utility. This would include funds for:
  - detailed state geologic assessments;
  - managing geologic storage demonstration projects;
  - siting geologic storage projects;
  - managing projects;
  - managing project closure;
  - managing post closure;
  - managing long-term maintenance;
  - managing any necessary site remediation; and.
  - siting and managing pipelines from CO_2 capture projects and main CO_2 trunk lines to geologic storage sites.

(Note: The intention is for the utility to spread project costs across all customers state-wide since the value of developing these sites has a statewide value).

• To be responsible for, in perpetuity, the CO_2 stored in the utility's sites.

(Note: It is intended that the new utility will indemnify the original sources of CO_2 from any and all liability for storage.)

• Authority to enter into contracts or use eminent domain power (depending on each jurisdiction's property law) to construct pipelines and secure ownership of pore space needed for storage.

Additional Issues:

- While the utility would not compete with otherwise commercial operations, such as EOR, it may help facilitate development of such commercial operations, and receive remuneration for doing so.
- The utility would need the ability to enter in to some kind of arrangement that would facilitate the receipt of storage from out-of-jurisdiction sources (e.g. charging management, and long-term maintenance fees).

APPENDIX C – FINANCIAL RISK MANAGEMENT FRAMEWORK

Excerpted table from: Chiara Trabucchi and Lindene E. Patton, "Storing Carbon: Options for Liability Risk Management, Financial Responsibility," World Climate Change Report, Vol. 2008, No. 170, The Bureau of National Affairs, Inc (September 3rd, 2008).

Table re-printed with permission from Chiara Trabucchi.

Table 1. Recommended Financial Risk Management Framework for CCS

PART 1. CCS SAFETY BOARD *Design Goal. Ensure siting / operating decisions that consider risk and minimize the potential for residual injury at the time of CCS site transfer.*	
Attributes	***Charge***
✓ Private / Public board, chartered as a federal government corporation. ✓ Comprises no less than nine members, including technical experts, government legal experts, private legal experts, financial experts and state / federal regulators. ✓ Term limits of no less than six years. .	✓ Approve siting ('go' v. 'no-go' decisions) for CCS projects. ✓ Oversee design and management of CCS projects. ✓ Serve as arbitrar for existing federal agencies authorized to address issues of technical safety, economic, climate and ecological preservation related to CCS projects. ✓ Certify completion of key project milestones, e.g., site closure, post-closure. ✓ Accept eventual title to CCS sites, including attendant financial responsibility for long-term care. ✓ Maintain financial and administrative management authority over the 'CCS National Trust,' including distribution of funds and the ability to use a percentage of collected funds to purchase risk transfer instruments, e.g., insurance / bonds.
PART 2. CCS NATIONAL TRUST ***Design Goal. Ensure availability of funds to pay for future (un)expected costs of long-term care and delimited compensatory damages.***	
Attributes	***Charge***
✓ Financed through a combination of: (a) initial authorizing funds, (b) a flat per unit fee on carbon sequestered during the operating life of the CCS facility, and / or (c) a transaction fee for carbon trades. ✓ Fee collection suspended when the Trust reaches a maximum dollar threshold. ✓ Fee collection resumes when accumulation falls below a prescribed minimum threshold. ✓ Balance of funds mandated between a maximum (ceiling) and minimum (floor) financial threshold.	✓ Address prospective risk, not known existing loss. ✓ Provide funds to pay for long-term care expenses associated with corrective (remedial) action and delimited compensatory damages resulting after the CCS facility is released from its post-closure obligations. ✓ Ensure trust balance (and fund contributions) map to the expected value of expenses / financial consequences likely to be incurred over the long-term. ✓ Trust balance should be re-evaluated when actual site-specific monitoring data become available, but on no less of a frequent basis than every three (3) years.
In addition to authorizing legislation for the CCSSB and the CCS National Trust, ADDITIONAL ENABLING LEGISLATION should:	
✓ **Establish Liability Provisions** ✓ **Identify Damages Thresholds** ✓ **Require Evidence of Financial Responsibility**	✓ **Provide for CCSSB Oversight Authority** ✓ **Allow for State Access to Funds in the CCS National Trust** ✓ **Address Miscellaneous Receipts Act Issues**

APPENDIX D – SELECTED AREAS OF PROPOSED EPA RULE ON CLASS VI WELLS

Note: This document was prepared as a background document for the MGA CO_2 Management Infrastructure Partnership sub-group. It is intended to highlight areas of the proposed EPA rule and preamble based on input received by the sub-group and is not a comprehensive overview of the proposed rule.

Prepared for the MGA CO_2 Management Infrastructure Partnership sub-group
By Jennifer Johnson, Great Plains Institute

September 29th, 2008

EPA UIC Class VI Proposed Rule

The draft of the proposed rule can be found at:
http://www.epa.gov/ogwdw/uic/wells_sequestration.html

Approach to developing Geologic Storage (GS) regulations

The EPA chose between four approaches that are outlined in section III of the Preamble:

1. Non-specific Requirements Approach
2. General Requirements approach
3. Tailored Requirements approach
4. Highly Specific Requirements approach

The EPA chose Regulatory Alternative #3 and explains their reasoning for doing so in Section III (A) of the Preamble. (73 FR 43504-43505)

Adaptive approach

"EPA will continue to evaluate ongoing research and demonstration projects, review input received on this proposal, and gather other relevant information, as needed, to make refinements to the rulemaking process. If appropriate, EPA will publish notices to collect new data before issuing a final rule on CO_2 injection for GS. EPA plans to issue a final rule in advance of full-scale deployment of GS. EPA will track implementation of the final GS rule to determine whether these requirements continue to meet SDWA objectives and, if not, revise them as needed. If new information gathered during implementation suggests the requirements need revisions, EPA will initiate the appropriate procedure, including public notice and comment." (73 FR 43522)

Definition of a Geologic Sequestration Project

- "an injection well or wells used to emplace a carbon dioxide stream beneath the lowermost formation containing a USDW. It includes the subsurface three-dimensional extent of the carbon dioxide plume, associated pressure front, and displaced brine, as well as the surface area above that delineated region." (draft 40 CFR § 144.81(d))

Class VI Well

"Wells used for geologic sequestration of carbon dioxide beneath the lowermost formation containing a USDW." (draft 40 CFR § 144.6(f))

CO_2 Composition (pollutant v. commodity)

The rule does not define CO_2 in this context but explains that GS projects could trigger federal law such as the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

and/or Resource Conservation and Recovery Act (RCRA) depending on the composition of the stream.

- However, "CERCLA exempts from liability certain ''federally permitted releases'' including releases in compliance with a UIC permit under SDWA. Therefore, Class VI requirements and permits will need to be carefully structured to ensure that they do not ''authorize'' inappropriate hazardous releases." (73 FR 43503 – 43504)
  - "EPA requests comment on particular situations where this might occur. EPA also requests comment on other considerations associated with the presence of impurities in the CO_2 stream related to CERCLA." (73 FR 43504)
- Waste

"Carbon dioxide stream" is defined to exclude hazardous wastes and the proposed rule solely applies to the CO_2 streams as defined in the proposed rules. This precludes the injection of hazardous wastes into Class VI wells (hazardous wastes defined in draft 40 CFR Part 261). (draft 40 CFR § 146.81(d))

- Commodity

"Whether or not a fluid could be sold on the market as a commodity is outside the scope of EPA's authority under the SDWA to protect USDWs." (73 FR 43496)

Area of review (AOR) and corrective action

- AOR is defined as "the region surrounding the geologic sequestration project that may be impacted by injection activity. The area of review is based on computational modeling that accounts for the physical and chemical properties of all phases of the injected carbon dioxide stream."

(draft 40 CFR § 146.81(d))

- The owner or operator must "delineate the area of review for a proposed geologic sequestration project, periodically reevaluate the delineation, and perform corrective action that meets the requirements of this section and is acceptable to the Director" as detailed in §146.84. (draft 40 CFR § 146.84)
- Corrective action is defined as "the use of Director approved methods to assure that wells within the area of review do not serve as conduits for the movement of fluids into underground sources of drinking water (USDW)." (draft 40 CFR § 146.81(d))
- "It is also possible that multiple owners or operators will be injecting CO_2 into formations that are hydraulically connected, and thus the elevated pressure zones may intersect or interfere with each other." (73 FR 43506)
- Because "traditional AOR delineation methods"…"would not be sufficient to predict the extent of this movement," the "EPA proposes that the owners or operators of GS wells delineate the AOR for CO_2 GS sites using computational fluid flow models designed for the specific site conditions and injection regime." (73 FR 43506) The multi-phase flow approach had broad stakeholder agreement, including with the IOGCC.
- Periodic Review: the Area of Review must be reevaluated at a frequency not to exceed 10 years. (73 FR 43507)
- "Today's proposal would give the Director the discretion to allow owners or operators to perform corrective action on an iterative, phased basis over the operational life of a GS project. Prior to injection, the owner or operator would identify all wells penetrating the confining or injection zone within the site AOR. However, the owner or operator may limit pre-injection corrective action to those wells in the portion of the AOR that would be intersected by the CO_2 plume or pressure front during the first years of injection. As the project continues and the plume expands, the owner or operator would continue to perform corrective action on wells further from the well to assure that all wells in the AOR that need corrective action eventually receive it. This

approach would ensure that any necessary corrective action is taken in advance of the CO_2 plume and associated area of elevated pressure approaching USDWs." (73 FR 43508)

- The emergency and remedial response plan (as required by § 146.94) and a demonstration of financial responsibility (as described by § 146.85) must account for the entire area of review, regardless of whether or not corrective action in the area of review is phased. (draft 40 CFR 164.84)

Basin-scale impacts

- The process of delineating the AOR will identify the potential area of impact from a specific project and the potential impacts of multiple owners and operators.
- EPA acknowledges that cross-state boundary issues may arise from GS and indicates that these issues are beyond the scope of the proposed rule. (73 FR 43497)
- EPA recognizes that states are developing their own regulatory frameworks and states that the EPA "seeks comment on any aspects of the ongoing State efforts to regulate the GS of CO_2 and how these efforts might be used to better inform a final Federal rulemaking." (73 FR 43497)

EOR projects –> GS projects (Class II –> Class VI)

- Owners and operators of Class I Industrial, Class II, or Class V experimental CO_2 injection projects may obtain a Class VI GS permit for their well(s) at the Directors discretion.

"If the Director determines that USDWs will not be endangered, such wells are exempt, at the Director's discretion, from the casing and cementing requirements at §§ 146.86(b) and 146.87(a) (1) through (3)." (draft 40 CFR 146.81(c))

- It should be noted that it is only the construction requirements of the Class I, II, or V wells that would be "grandfathered" and that the operator must meet every other requirement of the Class VI wells. (73 FR 43502)
    - "Today's proposal does not prescribe the specific cements to be used to plug abandoned wells in the AOR because industry standards, such as those developed by API or ASTM International, reflect the current state of the science and the expertise of industrial users on corrosion-resistant materials." (73 FR 43507)
- EPA seeks comment on their approach to EOR/EGR - GS projects as they recognize that some EOR/EGR operators "may wish to use wells for the purposes of production and GS prior to the field being completely depleted." (73 FR 43502)
- EPA also seeks comments on the approach to grandfathering in terms of whether additional requirements would be needed and "how grandfathering may affect compliance with the proposed requirements." (73 FR 43502)

GHG accounting for stored CO_2

- Regulation is restricted to preventing endangerment of USDWs and does not regulate surface/atmospheric releases although the prevention of CO_2 migration into USDWs "will likely prevent migration to the surface." (74 FR 43497)

Post-injection site care and site closure

- "EPA is proposing using a combination of fixed timeframe and a performance standard…" (73 FR 43519)
- As specified in the rule, the owner or operator must conduct monitoring for at least 50 years following the cessation of injection. "At the Director's discretion, the monitoring will continue until the GS project no longer poses an endangerment to USDWs."

"If the owner or operator can demonstrate" the above before 50 years the Director may approve an amendment to the plan to "reduce the frequency of monitoring or may authorize site closure before the end of the 50-year period." (draft 40 CFR § 146.93)

- "Prior to authorization for site closure, the owner and operator must submit to the Director a demonstration, based on monitoring and other site-specific data, that the carbon dioxide plume and pressure front have stabilized and that no additional monitoring is needed to assure that the geologic sequestration project does not pose an endangerment to USDWs." (draft 40 CFR § 146.93)
- Background on the EPA's approach: "EPA also reviewed an IOGCC Task Force report which suggests a 10-year time frame for the post-injection site care period which commences when injection ceases until the release of the operator from liability. Alternatively, some environmental programs— including the UIC Program—use a 30-year period as a frame of reference. While 10 years may be within the timeframe suggested in some studies, there are circumstances under which the potential risks of endangering USDWs will not decline within that timeframe given that stabilization may continue for several decades (USEPA, 2008d). Also, a 30-year timeframe can be appropriate for the types of fluids typically injected under the UIC Program (i.e., fluids that are liquids at standard pressure and temperature). Longer timeframes may be more appropriate for GS wells, because the fluid is likely to be stored in a supercritical phase, the plume for a full-scale GS project will likely be large, and substantial pressure increases will likely be observed during operation. However, once injection ceases, pressure will likely begin to dissipate and 30 years may be enough time for the plume and pressure front to stabilize." (73 FR 43519)

Financial assurance

- "The owner or operator must demonstrate and maintain financial responsibility and resources for corrective action (that meets the requirements of §146.84), injection well plugging (that meets the requirements of §146.92), post-injection site care and site closure (that meets the requirements of §146.93), and emergency and remedial response (that meets the requirements of §146.94)…" until requirements are met as detailed in Section §146.85. (draft 40 CFR § 146.95)
- "Owners or operators would no longer need to demonstrate that they have financial assurance after the post-injection site care period has ended. This generally occurs when the Director approves the completed post-injection site care and site closure plan and then determines that the injected fluid no longer poses a threat of endangerment to USDWs (e.g., the fluid no longer exhibits a propensity to move or migrate out of the injection zone to any point where it could endanger a USDW)." (73 FR 43520)

Issues that are beyond the scope of the proposed rule

- "This proposal does not require any facilities to capture and/or sequester CO_2; rather, this proposal focuses on underground injection of CO_2 and outlines requirements that, if finalized, would protect USDWs under the SDWA. The SDWA provides EPA with the authority to develop regulations to protect USDWs. The SDWA does not provide authority to develop regulations for all areas related to GS. These areas include, but are not limited to, capture and transport of CO_2; determining property rights (i.e., to permit its use for GS and for possible storage credits); transfer of liability from one entity to another; and accounting or certification for greenhouse gas (GHG) reductions. EPA is not proposing regulations for CO_2 under the Clean Air Act (CAA) in this proposed rulemaking." (73 FR 43495)

APPENDIX E – SUMMARIES OF SELECTED STATE ACTION RELATED TO CCS

Kansas

H.B. 2419 Carbon dioxide reduction act (passed 03/28/2007)[1]

The Carbon dioxide reduction act provides for the Kansas Corporation Commission to adopt rules and regulations relating to procedures and standards for safe and secure injection of carbon dioxide and maintenance of underground storage of carbon dioxide.

- Requires the Kansas Corporation Commission (KCC or Commission) to promulgate rules and regulations for injection and geologic storage of carbon dioxide.
- Bill states that the rules in place are for the "purpose of protecting the health, safety, and property of the people of the state, and preventing escape of carbon dioxide into the atmosphere and pollution of the soil and surface and subsurface water detrimental to public health or to plan, animal, or aquatic life…"
- Establishes the carbon dioxide injection well and underground storage fund that will be administered by the KCC and remitted to the state treasurer. The fund will cover activities ranging from the development and issuance of permits to remedial action plans and long-term remedial activities.
- Authorizes the KCC to determine fees for "permitting, monitoring, and inspecting operators of carbon dioxide injection wells and underground storage." These fees will be collected and deposited in the "carbon dioxide injection well and underground storage fund."
- A company or operator with a permit for carbon dioxide injection and storage must demonstrate the financial ability to meet closure costs as required by the Commission.
- The Commission may impose a penalty up to $10,000 (per day) for violations to the rules and regulations. The Commission may order injection to stop if CO_2 is escaping into the atmosphere or if the "soil or waters of the state are not being protected from pollution resulting from the injection of carbon dioxide."
- The Commission may enter property for various activities that are necessary to protect the public health and environment. Any representative entering land to prevent CO_2 escape or to clean up pollution shall "not be liable for any damages necessarily resulting therefrom, except damages to growing crops, livestock or improvements on the land."

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[1] Kansas HB 2419 (2007) *available at* http://www.kslegislature.org/legsrv-bills/showBill.do?id=167245.

- The bill also provides for several financial incentives for carbon capture and storage. This includes tax exemptions for CCS or utilization property, any electrical generation unit with CCS, and income tax deductions related to the amortizable costs of CCS or associated machinery and equipment.

KCC Proposed Regulations - Carbon Dioxide (CO_2) Storage, K.A.R. 82-3-1100 through 82-3-1120 and K.A.R. 82-3-311a[2] (released for public comment on 01/28/2009)

These proposed regulations detail the requirements for permitting a carbon dioxide storage project in Kansas, pursuant to the Carbon Dioxide Reduction Act of 2007.

Below are some key excerpts and highlights from the draft regulations:

CO_2 closure period is defined as: "the period of time from the permanent cessation of active injection or withdrawal operations until the beginning of the CO_2 postclosure period. During this period, the operator is responsible for activities that include the following:
(1) Monitoring the plume's pressure;
(2) monitoring the horizontal and vertical extent of the plume; and
(3) monitoring plugged and abandoned wells."

CO_2 postclosure period is defined as "the time after the CO_2 closure period in which all wells are plugged and monitoring of the storage reservoir is no longer necessary because the plume is stable and is not a threat to public health and safety or usable water."

CO_2 storage is defined as: "the storage of CO_2 in geologic strata that have been converted for CO_2 storage."

CO_2 storage reservoir and storage reservoir are defined as porous, brine-filled stratum of the earth that is separated from any other similar porous stratum by an impermeable stratum and is capable of being used for the storage of CO_2.
(82-3-1100. Definitions: carbon dioxide (CO_2) storage facilities.)

The definitions also define "leak" as a "loss of CO_2" that occurs "when CO_2 has migrated or is migrating from the wellhead, tubing, or casing or around the packer." Further, the regulations define a "loss of containment" as CO_2 that has "migrated or is migrating out of the CO_2 reservoir of facility" and "has migrated or is migrating from the CO_2 storage reservoir or beyond the authorized facility boundary."

K.A.R. 82-3-1101. CO_2 Storage facility; permit application. This section provides detailed technical requirements for obtaining a permit related to the site characterization, operation planning, the development of a storage facility safety plan, and demonstration of financial responsibility to "ensure proper operation and closure of the CO_2 storage facility. The form and amount of financial responsibility shall be approved by the director."

[2] The proposed Kansas Carbon Storage regulations are *available at* http://kcc.ks.gov/conservation/proposed_regs_032609.pdf.

K.A.R. 82-3-1102 Notice of application for permit and protest. "Parties that must be notified include each operator or mineral lessee of record within one-half mile of the boundary of the storage facility; each owner of record of the minerals in unleased acreage within one-half mile of the boundary of the storage facility; each landowner on whose land the storage facility will be located."

K.A.R. 82-3-1117. Postclosure determination. In order to receive a postclosure determination from the Conservation Division, the operator must demonstrate that:
"(1) The CO_2 plume has stabilized, is contained within the storage reservoir, and is not a threat to public health and safety and usable water.
(2) The CO_2 storage reservoir pressure is stable."

Postclosure determination and long-term responsibility:
"Upon written approval of postclosure status, the operator shall plug the remaining monitor wells in accordance with K.A.R. 82-3-1118. After the remaining monitor wells are plugged, the CO_2 storage facility permit shall be revoked, and any financial assurance instrument maintained by the operator shall be released. All future remediation or monitoring activities shall be performed by the state using funds from the commission's CO_2 remediation fund. (Authorized by and implementing K.S.A. 2007 Supp. 55-1637; effective P-_____.)"

K.A.R. 82.3.1119. Fees for CO_2 storage facilities and CO_2 storage wells.

- This section details the fees required for storage and associated wells including:
- $100/well in a permit application
- $250 for permit amendment
- $1000 annual fee per active or inactive unplugged storage well located within the boundary of the storage facility
- "The total annual fee shall be based on the number of the operator's CO_2 storage wells inexistence on the first day of November each year."
- 5 cents/ton injected – paid quarterly to the conservation division and held in the storage fund.

K.A.R. 82-3-311a. Drilling through CO_2 storage facility or CO_2 enhanced oil recovery reservoirs.

- This section details the requirements for entities that drill through a stratum or formation that has been used for CO_2 storage or CO_2 enhanced oil recovery.

North Dakota

March 2009

Summary of bills passed in the 2009 North Dakota Legislature: S.B. 2095[1] and S.B. 2139[2]

S.B. 2139 *Relating to ownership of subsurface pore space; to provide for application; and to declare an emergency*

This bill defines ownership issues related to pore space. The Policy section states that: "Undivided estates in land and clarity in land titles reduce litigation, enhance comprehensive management, and promote the security and stability useful for economic development, environmental protection, and government operations." Pore space is defined as "a cavity or void, whether natural or artificially created, in a subsurface sedimentary stratum." The bill states that the pore space title is vested in the surface owner and that it cannot be severed from the surface owner. Title to the pore space is conveyed with the conveyance of the surface property and may not be severed from the property. The pore space may be leased from the surface owner. This bill does not apply to pore space that has been previously severed from the surface estate. The bill further clarifies that: "In the relationship between a severed mineral owner and a pore space estate, this chapter does not change or alter the common law as of the effective date of this chapter as it relates to the rights belonging to, or the dominance of, the mineral estate."

S.B. 2095 *Relating to priorities in permitting carbon dioxide geologic storage projects; to provide a penalty; and to provide a continuing appropriation*

This bill addresses many issues related to permitting a carbon dioxide geologic storage project. A new chapter of the North Dakota Century Code is created that states that it is in the public interest to promote geologic storage projects and that it will have economic and environmental benefits. The primary regulatory agency with authority over permitting and compliance is the North Dakota Industrial Commission. This bill closely follows many elements of the Interstate Oil and Gas Commission Model Rules and Regulations.

Below are some key highlights from the bill:

Definitions

Carbon dioxide is defined as: "carbon dioxide produced by anthropogenic sources which is of such purity and quality that it will not compromise the safety of geologic storage and will not compromise those properties of a storage reservoir which allow the reservoir to effectively enclose and contain a stored gas."

Reservoir is defined as: "a subsurface sedimentary stratum, formation, aquifer, cavity, or void, whether natural or artificially created, including oil and gas reservoirs, saline formations, and

[1] North Dakota Senate Bill 2095 *available at* http://www.legis.nd.gov/assembly/61-2009/bill-text/JQTA0300.pdf.

[2] North Dakota Senate Bill 2139 *available at* http://www.legis.nd.gov/assembly/61-2009/bill-text/JQTB0300.pdf.

coal seams suitable for or capable of being made suitable for injecting and storing carbon dioxide."

Geologic storage is defined as: "the permanent or short-term underground storage of carbon dioxide in a storage reservoir."

- The Commission has the authority to "dissolve or change the boundaries of any commission-established oil or gas field or unit that is within or near a storage reservoir's boundaries."
- The notice of a permit hearing must be given to "each mineral lessee, mineral owner and pore space owner within the storage reservoir and within one-half mile of the storage reservoir's boundaries." Surface owners of land overlying the storage reservoir that are within one-half mile of the reservoir's boundaries must also be notified. The reservoir is delineated by definition as the geologic area that is suitable for or capable of geologic storage (which could be permanent or short-term). This delineation does not take into account the predicted movement of the carbon dioxide plume and associated pressure front that will create the physical boundary.

Geologic storage as an activity in the public interest:
"It is in the public interest to promote the geologic storage of carbon dioxide. Doing so will benefit the state and the global environment by reducing greenhouse gas emissions. Doing so will help ensure the viability of the state's coal and power industries, to the economic benefit of North Dakota and its citizens."

Permit requirements:
- The storage facility must be "suitable and feasible for carbon dioxide injection and storage."
- The storage operator must gain consent of "persons who own at least 60% of the storage reservoir's pore space."
- That the "carbon dioxide to be stored is of a quality that allows it to be safely and efficiently stored in the storage reservoir."
- The Commission shall find "whether or not the storage facility contains commercially valuable minerals and, if it does, a permit may be issued only if the commission is satisfied that the interests of the mineral owners or mineral lessees will not be adversely affected or have been addressed in an arrangement entered into by the mineral owners or mineral lessees and the storage operator."
- Environmental/human welfare:
    - "The proposed storage facility will not adversely affect surface waters or formations containing fresh water."
    - "Carbon dioxide will not escape from the storage reservoir."
    - "The storage facility will not endanger human health or unduly endanger the environment."
    - "The storage facility is in the public interest."

Amalgamation of property interests
- The Commission has the authority to amalgamate property interests between consenting and non-consenting persons into the storage facility.

Environmental Protection – Reservoir integrity

- "The Commission shall take action to ensure that a storage facility does not cause pollution or create a nuisance. For the purposes of this provision and in applying other laws, carbon dioxide stored, and which remains in storage under a commission permit, is not a pollutant nor does it constitute a nuisance."

Carbon dioxide administrative fund

- A fee per ton of injected CO_2 must be paid to the Commission by storage operators covering construction, operational, and pre-closure phases of a project. This fund will be solely used for project permitting, construction, operations, and pre-closure phases and may be used to compensate other agencies that regulate a storage facility.

Carbon dioxide trust fund

- A fee per ton of injected CO_2 must be paid to the Commission that will cover anticipated expenses related to the long-term monitoring and management of a closed storage facility. This fund will be solely used for long-term monitoring and management of a closed storage facility and may be used to compensate other agencies that regulate a storage facility.
- The Commission will provide a report every 4 years (starting after the first report due in December 2014) to the legislative council that discusses "whether the amount in the carbon dioxide storage facility trust fund and fees being paid into it are sufficient to satisfy the fund's objectives."

Title to carbon dioxide

Title to and liability for the carbon dioxide injected and stored in a reservoir is held by the storage operator until the Commission issues a certificate of project completion. The storage operator is liable until project completion for "any damage the carbon dioxide may cause, including damage by carbon dioxide that escapes from the storage facility."

Requirements for obtaining a certificate of project completion – release – transfer of title and custody

Injections into the reservoir must end, there must be a public notice and hearing, the commission must consult with the state department of health, the certificate will not be issued until at least 10 years after carbon dioxide injections end. Some of the major conditions that must be met by the storage operator include: "storage reservoir is reasonably expected to retain the carbon dioxide stored in it."

Washington

Washington established statewide greenhouse gas emissions reduction goals in May 2007 (set forth earlier in February of 2007) and an emissions performance standard (EPS)[1] for all baseload electric generation (in effect as of June 30th, 2008) that is generated within or outside of Washington through ESSB 6001.[2] This bill also included rules for projects that aim to meet the EPS with a geologic storage project.

Facility Requirements

These rules require parties to submit "sequestration plans" that would be reviewed under the authority of the Energy Facility Site Evaluation Council in partnership with the Department of Ecology. These rules include requirements for commencing the geologic storage project and for providing financial assurance related to implementation of the geologic storage plan. New facilities would be required under the rules to commence sequestration within 5 years of plant operation or to purchase emissions reductions in the absence of sequestration (facilities underway may be exempted under certain criteria by the Energy Facility Site Evaluation Council). The Department of Ecology was also directed to draft rules on geologic sequestration projects.[3]

Permit Requirements

The rules set out permit requirements (through a waste discharge permit application), including: what type/depth of formations; removal of contaminants from CO_2; a monitoring system that detects leakage to the atmosphere, surface or groundwater; financial assurance requirements and options for closure or post-closure expenses. The post-closure period is performance based and verified through modeling and monitoring, subject to a determination that there is "high confidence" in the effectiveness of the containment system and trapping mechanisms. The operator is required to continue to pay for all fees and expenses until the post-closure period is complete, subject to approval by the Department of Ecology.

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[1] Chapter 80.80 RCW Greenhouse gases emissions — base load electric generation performance standard, *available at* http://apps.leg.wa.gov/RCW/default.aspx?cite=80.80.

[2] See the Senate Report on ESSB 6001 *available at* http://www.leg.wa.gov/pub/BillInfo/2007-08/Pdf/Bill%20Reports/Senate/6001-S.SBR.pdf.

[3] Carbon dioxide mitigation program, greenhouse gases emissions performance standard and sequestration plans and programs for thermal electric generating facilities. *Available at* http://apps.leg.wa.gov/WAC/default.aspx?cite=173-407.

Permanent sequestration defined

The rule states defines permanent sequestration "as the retention of greenhouse gases in a containment system using a method that is in accordance with standards approved by the department and that creates a high degree of confidence that substantially ninety-nine percent of the greenhouse gases will remain contained for at least one thousand years."[4] This is the percentage of containment and time period that the IPCC indicated could be sequestered in a properly managed site in their 2005 report.[5]

[4] WAC 173-407-110, *available at* http://apps.leg.wa.gov/WAC/default.aspx?cite=173-407-120.
[5] WAC 173-218-115, *available at* http://apps.leg.wa.gov/WAC/default.aspx?cite=173-218-115.

Wyoming

The Wyoming Joint Judiciary Committee has been studying and analyzing the issues that should be addressed in Wyoming to move forward on developing CCS projects. The Wyoming legislature has passed several pieces of significant legislation in the 2008 and 2009 sessions. In the 2008 Budget session, the Joint Judiciary Committee sponsored two bills, discussed below (HB 90 and HB 89) that were passed and signed into law. Early drafts of the these two bills that were prepared for committee discussion purposes include staff comments on how they were or were not including language from the IOGCC Model Rules and Regulations.[1] This is instructive to see how one state adapted the IOGCC rules to their particular jurisdiction as each state will likely take a unique approach in several areas.

In the 2009 session, three bills (HB 80, HB 57 and HB 58) have passed that are also summarized below. The Joint Judiciary Committee continues their process to study and develop supporting legislation on carbon capture and sequestration.

2008

H.B. 89 Property rights

HB 89 defines the ownership of pore space rights. It states that the surface estate owns the right to the pore space unless the pore space right (distinct from mineral rights) has been severed (previously conveyed in the same process as a mineral right is conveyed or explicitly excluded from the conveyance) from the surface estate. The bill also states that this statute does not change or alter the common law dominance of the mineral estate.

H.B. 90 Authority

Wyoming designates the Department of Environmental Quality (DEQ) as the authority to regulate geologic sequestration projects and to develop the rules for GS regulation. Interim committee staff commented in the draft bill that they could not put the authority into the oil and gas chapter of their state regulations because oil and gas regulations in Wyoming are concerned with conserving oil and gas whereas the geologic storage statutes are to safely and effectively

[1] Draft version of 2008 Wyoming HB0090 with staff comments *available at* http://legisweb.state.wy.us/2007/interim/Jud/BILLS/08lso-0047w5.pdf; Draft version of 2008 Wyoming HB0089 with staff comments *available at* http://legisweb.state.wy.us/2007/Interim/JUD/BILLS/08lso-0080w2.pdf.

sequester CO_2. Wyoming has primacy over Class I-V wells. Forthcoming EPA rules will indicate the approach for a state role in regulation and if states may apply for primacy for class VI wells. The bill details some of the requirements that should be met for geologic sequestration permits.

In addition, H.B. 90 also directs the state oil and gas supervisor, the state geologist, and the director of the DEQ to convene a working group[2] that will develop bonding requirements for geologic storage wells that will extend from the operations period through the post-closure period, stating that "at minimum provide assurance for closure and reclamation costs, post-closure inspection and maintenance costs and environmental monitoring, verification and control costs." The DEQ has been appropriated $250,000 to carry out the requirements and will report back to the designated committees by September 2009.

Enhanced Oil Recovery Projects

The bill does not extend to EOR operations but only projects that "convert" to geologic sequestration after ceasing EOR operations. This conversion would transfer the authority over the project from the Oil and Gas Conservation Commission (OGCC) to the DEQ. The IOGCC would have authority over any subsequent extraction of CO_2 from the sequestration site.[3]

Liability

The bills do not clarify the entity that would be liable for any migration of CO_2 beyond the project boundary or for any damages incurred. The bill does iterate that the state would not be liable for failure to comply with the relevant sections.

2009

H.B. 80 Sequestration site unitization

This bill places authority for the unitization of geologic sequestration sites under the Wyoming Oil and Gas Conservation Commission. The stated purpose of the bill is to protect corresponding rights (defined as the rights of all affected pore space owners to "concurrently

[2] *See* the following DEQ web page for details on the working group purpose and structure *at* http://deq.state.wy.us/out/downloads/Carbon%20Sequestration%20Working%20Group%20Charter%20Rev%201.pdf.

[3] Wyoming HB 0090.

share in the economic benefits generated by using the pore space in the unit area") in addition to "compliance with environmental requirements and to facilitate the use and production of Wyoming energy resources." The permit application must provide information regarding the owners of all surface estates/pore space within the project 'unit' in addition to those owners who are adjacent to the unit. The unitization plan must be ratified or approved by 80% of the property interests in the pore space unit (with provisions for reduction to 75%).[4]

The bill also requires permit applicants to include a proposed plan for determining how much pore space and capacity is allocated to each separately owned tract within the geologic storage unit or another method to allocate economic benefit based on pore space ownership. This plan should result in an allocation that "represents, so far as can be practically determined, each tract's actual share of the pore space to be used." The bill further requires a proposed plan for "generating economic benefits for the use of pore space within the unit area."[5] In the draft bill, this methodology for allocation was to be used to determine how owners are "allocated carbon credits or other economic benefits by use of the pore space."[6]

The staff comments on the draft bill provide insight on the questions that will likely need to be addressed in relation to allocating carbon credits for sequestering CO_2. The staff has commented that their approach to carbon credits and any other economic benefit allocated is to prevent a situation that would be cause for a constitutional takings claim. Their approach follows the unitization statutes for oil and gas which have been held as constitutional.[7]

H.B. 57 Ownership of pore space-dominance of mineral estate

This bill clarifies the relationship between the mineral estate and the surface owner, stating that: "For the purpose of determining the priority of subsurface uses between a severed mineral estate and pore space as defined in subsection (d) of this section, the severed mineral estate is dominant

[4] Wyoming House of Representatives, HB 80, 60th Legislature (2009). *Available at* http://legisweb.state.wy.us/2009/Enroll/HB0080.pdf.

[5] Ibid.

[6] Wyoming Joint Judiciary Committee Working Draft 09LSO-0153.W1, Section (Vi), "Sequestration site unitization." *Available at* http://legisweb.state.wy.us/2008/interim/Jud/BILLS/09lso-0153w1.pdf.

[7] Ibid, following section (iv).

regardless of whether ownership of the pore space is vested in the several owners of the surface or is owned separately from the surface."[8]

H.B. 58 Responsibilities of sequestration injectors and pore space owners

This bill clarifies that the ownership of "all material" injected into a site for geologic sequestration belongs to the injector. It states that any surface owner or subsurface owner shall not be held liable for geologic storage in their property on the basis of their surface/subsurface interest or by giving consent to the operator to inject.[9] Staff comments on the draft bill clarified that this bill defines who is not liable as opposed to imposing strict liability on the injector as there are statutes that may hold others liable (such as an oil and gas operator that drills a new well over a sequestration site without following Oil and Gas Commission rules).[10]

[8] Wyoming House of Representatives, HB 57, 60th Legislature (2009). *Available at* http://legisweb.state.wy.us/2009/Enroll/HB0057.pdf.

[9] Wyoming House of Representatives, HB 58, 60th Legislature (2009). *Available at* http://legisweb.state.wy.us/2009/Enroll/HB0058.pdf.

[10] Wyoming Joint Judiciary Committee Working Draft. *Available at* http://legisweb.state.wy.us/2008/interim/Jud/BILLS/09lso-0154w1.pdf.

New Mexico Report on Geologic Sequestration Regulations

Summary prepared by Jennifer Johnson, Great Plains Institute

December 2008

New Mexico Energy, Minerals, Natural Resources Department (EMNRD), Oil Conservation Division (OCD), *Blueprint for the regulation of geologic sequestration of carbon dioxide in New Mexico*, prepared by Mark Fesmire, Adam Rankin, David Brooks, and William V. Jones (1 December 2007).

The Governor's Executive Order 2006-69 directed New Mexico's Energy, Minerals, and Natural Resources Department (EMNRD) to work with a stakeholder group to determine statutory and regulatory requirements and to propose rules for carbon capture and sequestration. The EMNRD was tasked with examining these issues and putting together a report based on their analysis and stakeholder input.

The Oil Conservation Division (OCD) was identified as the appropriate agency to work on the regulatory framework for CCS. The OCD has regulatory oversight over current CO_2 injection projects (and future EOR) along with experience with drilling and deep-well injection. The OCD shares responsibility with the New Mexico Environment Department (NMED) in New Mexico for managing the EPA's Underground Injection Control Program (UIC).

The OCD sees potential coordination with state and federal regulatory bodies to work towards protection of human health and the environment together.

The Blueprint highlighted issues for implementing a regulatory framework including:

- Potential Current and Future Conflicts with Subsurface interests;
- Ownership of Geologic Formation/Pore Space and the Right to Sequester; and
- Long-term Liability.

The Blueprint goes on to highlight issues for addressing statutory issues including:

- Authority to Regulate Carbon Sequestration;
- Ownership of Geologic Formation/Pore Space;
- Unitization of Recoverable Hydrocarbons;

  Condemnation of Storage Space and Transportation Corridors by Eminent Domain; and
- Long-term Liability.[1]

[1] EMNRD (1December 2007), 4 – 11.

The OCD has wide authority in various applications where CO_2 injection is used in oil and gas operations. The report identifies that the OCD needs to be given authority to regulate anthropogenic CO_2 injection for sequestration purposes alone, especially since the majority of sequestration potential exists in non-EOR related reservoirs. Also, this authority must extend to carbon that occurs from non oil and gas operations as well.

The Surface Owners Protection Act should protect the interests of surface owners related to CO_2 sequestration activities, beyond current oil and gas production protections. According to the 1990 New Mexico Supreme Court, the majority of states hold that pore space belongs to the surface owner. The report asked some key questions:

- *Can the state claim ownership on the basis that it is in the public interest, as used in common law rules for formation recharge?*
- *How to protect the future mineral rights interests?*
- *When is CO_2 considered storage, as opposed to part of an EOR project (which does not require permission of the pore space owner)?*
- *The sequestration regulatory framework must apply to formations including hydrocarbon reservoirs and others.*[2]

Depleted Oil and Gas Reservoirs: Most jurisdictions agree that once mineral reserves have been depleted, that the surface property owner does own that pore space and has the right to fill it with non-native gases/minerals.

Deep Saline Formations: Underground waters are in the public domain (in NM), whereas the formation is the property of the surface estate. Any action besides recharging the formation may require compensation.

Deep Coal Seams: There formations present technical challenges and will most likely be treated legally in the same sense as depleted oil and gas formations.[3]

Unitization of Recoverable Hydrocarbons

The Report states that the New Mexico Statutory Unitization Act gives the OCD some authority in unitizing pools. It is anticipated that some of the existing language could impose barriers to operating sequestration of a field as a unit, because of minority interest rights.

Challenges and potential solutions identified in the Blueprint are as follows:

- Voluntary agreement for injectors to unitize a field for sequestration purposes;
- Unitization of large enough areas;
- Design language to allow for varying levels of oil to be recovered from sequestration activities in a field unit (as opposed to a minimum requirement as in current statute);
- Statutory continuation of expiring leases for sequestration planning and implementation;

[2] EMNRD (1 December 2007), 18.

[3] All of the three formations listed will likely require compensation to the appropriate interest owners and/or acquisition of the right to sequestration through condemnation if voluntary negotiations are not successful.

- Need to settle whether there is a conflict between the purpose of sequestration and the unitization of federal minerals (and areas with strata that includes federal minerals); and
- Effect of Indian ownership on unitization.[4]

Condemnation of Storage Space and Transportation Corridors by Eminent Domain

"Subsurface sequestration space and surface easements for pipelines and injection facilities will be necessary for a large-scale sequestration program."[5]

The OCD would need to adopt provisions similar to those for condemnation of underground storage space for natural gas in case of inability to reach agreement with property owners. There may be a conflict with mineral rights owners who could argue that since oil and gas reservoirs are never fully depleted, that they should be compensated in case of harm or interference. New Mexico law only protects against condemnation of storage space if oil can be produced in payable quantities. Similar law applies to gas strata, unless that formation has greater value or utility as a storage reservoir.

New Mexico has the authority to condemn surface land for pipeline construction, including CO_2 pipelines (applies to transportation lines, or trunk lines, not gathering/feeder lines).

Questions for their Workgroup:

- How will the size/scale of units/formations affect difficulty/cost of condemnation?
- What effect does targeted condemnation have on other intervals? Can hydrocarbon exploration/production continue in other intervals?
- What's the method of valuation for condemnation?

The report states that it is important to create a process for condemnation of the pore space for CO_2 storage for situations when the surface owners and the injectors cannot agree on terms. The Report details a methodology for determining the fair market value of pore space for storage of natural gas that can be applied to sequestration space.[6]

[4] EMNRD (1 December 2007), 36 – 37.
[5] EMNRD (1 December 2007), 37.
[6] EMNRD (1 December 2007), 37 – 38.

Authority to Transfer Liability /Ownership to State

Liability issues will play a key role in influencing both public acceptance of sequestration and the feasibility of sequestration projects from an industry point-of-view. Most literature on liability and sequestration indicates that long-term liability will have to be passed on to the public sector in order to maintain economic viability and ensure investment by industry in the technology. The public sector, with its long-standing institutions could maintain the projects over time or could devise some limited liability in terms of number of projects or time period. Of many questions on the public liability issue, the report asks if the state should "accept liability for those projects initiated within a limited time frame (e.g. first 5 years of CO_2 sequestration)?"[7]

Authority to Impose Sequestration Fee on Injected CO_2 Volumes and Exemptions

If the state assumes the liability and ownership of sequestered CO_2, there should be a fund set up to cover the costs of managing the projects post operational/closure phases. Various models (including pre-existing ones such as CERCLA, RCRA, and the Price Anderson Act) could be used for purchasing insurance in the private market or a fee could be assessed per volume sequestered.

Texas H.B. 3431 proposes a tax-exemption for anthropogenic CO_2 use. The tax reductions detailed in the bill would not apply if the measuring and verification determine a different amount is being stored than expected.

Authority to Bond Injection Projects and Facilities

The state needs to determine if bonding will be required in order to cover costs of reclaiming project sites and facilities following injector abandonment or insolvency.

Authority to Enter Land for Inspection

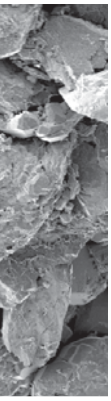
The state must have the authority to enter surface estates for maintenance and inspection at sequestration sites.

[7] EMNRD (1 December 2007), 39.

Appendix F - World Resources Institute CCS Guidelines
Executive Summary reprinted with permission from the World Resources Institute (WRI), "CCS Guidelines: Guidelines for Carbon Dioxide Capture, Transport, and Storage," Washington DC: WRI (2008).

EXECUTIVE SUMMARY

The Carbon Dioxide Capture and Storage (CCS) Guidelines effort was initiated to develop a set of preliminary guidelines and recommendations for the deployment of CCS technologies in the United States, to ensure that CCS projects are conducted safely and effectively. As such, the CCS Guidelines are written for those who may be involved in decisions on a proposed project: the developers, regulators, financiers, insurers, project operators, and policymakers. These Guidelines are intended to guide full-scale demonstration of and build public confidence in CCS technologies by informing how projects should be conducted.



Worldwide increases in energy demand coupled with a continued reliance on fossil fuel resources have contributed to a significant increase in atmospheric levels of carbon dioxide (CO_2). This increase shows no signs of slowing. According to the International Energy Agency's (IEA's) *World Energy Outlook 2007*, the projected growth in energy demand will translate into a 57 percent rise in energy-related CO_2 emissions by 2030 (IEA 2007). Others argue —especially in the recent high energy price environment—that global energy demand will be much lower than the IEA forecast.

Scenarios for stabilizing climate-forcing emissions suggest atmospheric CO_2 stabilization can only be accomplished through the development and deployment of a robust portfolio of solutions, including significant increases in energy efficiency and conservation in the industrial, building, and transport sectors; increased reliance on renewable energy and potentially additional nuclear energy sources; and deployment of CCS. Slowing and stopping emissions growth from the energy sector will require transformational changes in the way the world generates and uses energy.

CCS is a broad term that encompasses a number of technologies that can be used to capture CO_2 from point sources, such as power plants and other industrial facilities; compress it; transport it mainly by pipeline to suitable locations; and inject it into deep subsurface geological formations for indefinite isolation from the atmosphere. CCS is a critical option in the portfolio of solutions available to combat climate change, because it allows for significant reductions in CO_2 emissions from fossil-based systems, enabling it to be used as a bridge to a sustainable energy future.

In technology development there is a period referred to as the "valley of death," where a technology has been proven in the laboratory and on a small scale, but has yet to become commercially viable. CCS technology has progressed quickly from being a concept to a key part in proposed climate change mitigation plans. This progression is partly the result of early successes in pilot capture demonstrations and field validation tests, where small volumes of CO_2 have been injected for research purposes. It is also due in large part to the experience that has been gained injecting CO_2 for enhanced oil recovery over the past three and a half decades. There are skeptics who believe that CCS remains infeasible, with continued interest driven by the lack of any other viable solution that would allow the continued use of coal. To achieve the potential benefits of CCS and prove that safe and permanent storage can be realized, it is important to continue large-scale demonstration and deployment of this technology.

Although the CCS industry is still in its formative stages, in developing the CCS Guidelines participants were able to draw from a wealth of information, analogous regulatory experience, and industrial best practices. As the knowledge and understanding of the suite of CCS technologies grow, these Guidelines will be revised to reflect emerging best practices. The potential for further development is most evident where the CCS Guidelines identify areas for additional research and, hence, suggest that extra care be taken during the early deployment phase.

This effort has progressed in the context of a swiftly changing regulatory landscape of CCS-specific regulations emerging at the U.S. federal and state levels. The CCS Guidelines complement these efforts by focusing a group of experts on specific issues in order to examine, describe, and explain best practices for the implementation of specific projects. In addition, the Guidelines introduce some larger policy issues that go beyond the regulatory frameworks proposed by federal and state governments. Appendices B, C, and D categorize the Guidelines according to the intended implementing audiences: Appendix B presents information intended for Congress, Appendix C presents information intended for regulators, and Appendix D presents information intended for operators.

A key finding of the stakeholder process is that even though additional research is needed in some areas, there is adequate technical understanding to safely conduct large-scale demonstration projects.

The Process

The purpose of the CCS Guidelines is not to make a case for or against CCS, but rather to develop practical considerations for demonstrating and deploying CCS technologies. The starting point for the CCS Guidelines stakeholder discussions was that CCS will most likely be needed to achieve the magnitude of CO_2 emissions reduction required to stabilize and reduce atmospheric concentrations of greenhouse gases (GHGs).

These Guidelines represent current understanding of how to implement CCS technologies. Discussions of the Guidelines were predicated on the following principles:

1. Protect human health and safety.
2. Protect ecosystems.
3. Protect underground sources of drinking water and other natural resources.
4. Ensure market confidence in emission reductions through regulatory clarity and proper GHG accounting.
5. Facilitate cost-effective, timely deployment.

To develop the CCS Guidelines, the World Resources Institute (WRI) convened a diverse group of over 80 stakeholders, including representatives from academia, business, government, and environmental nongovernmental organizations (NGOs). Business participants included those most likely to be involved in CCS projects: fossil energy, electric utility, insurance and service providers. These experts represent a variety of disciplines, including engineering, finance, economics, law, and social science. To have the technical discussions needed to arrive at a robust set of guidelines, all stakeholders agreed to focus the discussions and guidelines on how and not whether to implement a CCS project. These Guidelines are written in the U.S. context, since the stakeholder process involved primarily U.S. experts. WRI is in the process of conducting additional work to customize the Guidelines for other key countries, taking into account their specific local conditions and context.

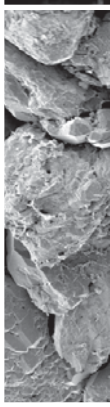
These Guidelines reflect the collective agreement of the contributing stakeholders, who offered strategic insights, provided extensive comments on multiple iterations of draft guidelines and technical guidance, and participated in workshops. The authors and editors strived to incorporate these sometimes diverse views. In so doing, they weighed conflicting comments to develop guidelines that best reflect the views of the group as a whole, and acknowledged diverging opinions among stakeholders. Although these Guidelines reflect the collective input of the contributing stakeholders, individual stakeholders were not asked to endorse them. The identification of the individual stakeholders should not be interpreted as, and does not constitute, an endorsement of these Guidelines by any of the listed stakeholders.

Since this project's inception, rapid expansion of and interest in CCS technologies have accelerated movement toward the development of regulations and policies to support CCS. As such, the organizational and individual composition of the contributing stakeholders has changed over time. The stakeholders listed in this document contributed by attending workshops on the draft Guidelines between December 2007 and July 2008, and/or providing written comments. Other key stakeholders contributed early on in shaping the Guidelines. A detailed description of the CCS stakeholder process is provided in Part 1 and Appendix A of these Guidelines.

Limitations of the Guidelines

These Guidelines address most of the technical issues involved in the design, implementation, and decommissioning of CCS. However, it is important to note that there are other important issues involved in successful scale-up of CCS that were beyond the scope and expertise of the WRI-convened stakeholder process. These issues include:

- Procedures for engaging local communities in the design and implementation of CCS,
- Guidelines on the compensation of property owners regarding pipeline right-of-way and pore space ownership,



- Application of public right-to-know information disclosure and third-party verification of operator-submitted information, and
- How to address any upstream impacts associated with the increased use of coal per unit of energy generated as a result of the energy penalty associated with the use of CCS.

While the Guidelines include references to resources for these issues, they are not intended to provide a comprehensive treatment of these issues. Throughout the Guidelines, areas are highlighted where more research is needed, and the Guidelines can be revised to reflect emerging best practices as at-scale experience is gained. Also, many of the policy recommendations (such as the framework for post-closure stewardship) explore the need for additional legislation, but without going into detail. Going forward, WRI will seek opportunities to address these and other issues by convening appropriate stakeholders and by drawing from experience gained through other relevant initiatives. Finally, although this first edition of the Guidelines frames the important policy issues surrounding GHG accounting, liability, financial incentives, and long-term stewardship associated with CCS projects, the stakeholders acknowledge that more discussion—and in some cases experience—is needed to propose more robust Guidelines for these important areas.

Who Should Read This Document

These Guidelines present recommendations and best practices for those involved in the development and implementation of CCS projects. The document also provides a comprehensive introductory reference for those new to CCS who seek to understand how to responsibly conduct projects. A potential operator, financier, insurer, or regulator can use these Guidelines as a benchmark in evaluating potential project plans and as a reference on the current technical understanding of best practices for CCS, and a policymaker can use them to establish regulatory and investment frameworks that enable successful and responsible CCS deployments. It is important to note that these Guidelines are not intended to replace or provide the detailed technical knowledge that would be required to select the location for or to design and operate a CCS project. In fact, one of the findings derived from this process is that each CCS project will be unique, and a team of qualified experts will be needed to design and operate each project.

Organization of the Guidelines

The Guidelines are divided into three primary parts: Capture, Transport, and Storage. Nevertheless, decisions made regarding the specific configuration of the capture system affect the project through the final phases of post-closure storage. Similarly, up-front planning regarding the capacity of the storage reservoir in comparison to the projected CO_2 emissions is essential. A CCS project requires thoughtful integration to ensure that materials are fit-for-purpose and that the comprehensive impacts of the project are evaluated both throughout the project chain and through the expected project life cycle.

These CCS Guidelines were developed by a diverse group of stakeholders, including over 80 contributers from academia, business, government, and environmental nongovernmental organizations (NGOs).

CAPTURE

While entities have commercially deployed CO_2 capture technologies on industrial processes for various purposes, including the production of streams of CO_2 for use in enhanced oil recovery (EOR) and for sale as a food-grade product, capture technologies have not been demonstrated on commercial-scale power plants. Demonstration and potential widespread deployment of capture technologies will require owners and operators of power plants to learn new processes and adopt additional safety protocols, but these methods, guidelines, and regulations are in use in other industries. The current state of CO_2 capture technologies and the potential environmental impacts of the technologies are summarized. The Guidelines also include an analysis of the existing U.S. regulatory structure for carbon capture and highlight considerations for deployment.

TRANSPORT

Today, there are well over 3,000 miles of CO_2 pipelines in operation in the United States. This operational experience provides a basis for the development of a CO_2 pipeline infrastructure for CCS. The Guidelines build on this experience, and are intended to inform pipeline infrastructure development for widespread deployment of CCS. The transport element of the CCS Guidelines describes existing standards for CO_2 pipeline design, operational, and regulatory practices, and identifies potential issues associated with more geographically diverse transportation of CO_2 for the purpose of geologic storage.

STORAGE

The storage plan for an individual site ultimately must reflect the heterogeneity in local geological conditions, be informed by knowledge gained during project operations, and be based on site-specific data. The Guidelines reflect the current understanding of operational guidelines for permanent underground storage. Proper site characterization and operation are critical to successful geologic storage efforts. Also integral to safe and effective geologic storage is developing a sound measurement, monitoring, and verification (MMV) plan, conducting a comprehensive risk analysis, and establishing a plan for the CCS project that includes considerations for long-term site stewardship.

Next Steps

As CCS technology progresses around the world, an emergent standard of conduct will evolve for both regulation of CCS as well as industrial best practices. The CCS Guidelines are intended to inform those considering CCS policies and regulations in the United States and those who manage the various aspects of CCS demonstration and full-scale projects. The Guidelines can be revised as understanding of the technology grows. Additionally, WRI will leverage this work to develop Guidelines for an international audience, including work with local stakeholders to develop Guidelines that can be implemented in other countries, such as China.