GEOLOGIC CO_2 SEQUESTRATION
ISSUE SPOTTING AND ANALYSIS WHITE PAPER

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OBJECTIVE

This paper has been prepared for APPA's electric utility members and water utilities for the purpose of surveying the wide range of issues that will influence the implementation of geologic carbon sequestration. As with many things, sequestration is not as simple as it seems. Injection of anything into the subsurface is regulated. Which agencies will act to regulate and the criteria they will follow depends upon the answer to the questions raised in this paper – questions that Congress and state legislatures will need to address if sequestration is to be implemented on a scale remotely adequate to make a difference in the amount of CO_2 reaching the atmosphere.

Without a doubt sequestration projects will go forward. Many are already underway. Nothing in this White Paper should change anyone's view on the technology available for geologic sequestration. Nor should anyone read this paper to suggest that there are fatal legal impediments to these projects. There are substantial legal issues and a prudent manager would be well advised to factor these issues into the business plan for a sequestration project.

Much of this paper looks at the existing rules that apply to geologic sequestration. From where we stand today it is these rules that will apply absent action by legislative bodies. For example, if the CO_2 being injected is a waste we next need to know if its hazardous waste and

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regulated under RCRA. If injection is limited to producing oil and gas operations for enhanced recovery, then injection will be regulated by the state agencies that permit oil and gas operations.[2] The policies and procedures of these agencies and which permits might be required are sometimes radically different state-by-state having the potential to drastically change the regulatory burden and economics of any project.

Common law theories dealing with trespass, mineral rights and water rights all are implicated as injection may result in trespass or harm to surface property rights, mineral rights or water rights. Depending upon in which state injection operations occur, there are significant questions regarding the ownership and access to the subsurface spaces where the CO_2 will be placed. As the CO_2 is intended to remain in the ground in perpetuity, then we also need to examine who remains responsible in perpetuity. Regardless of whether these entities are private corporations or public entities long-term liability issues will need to be address and understood. Absent new legislative action existing statutes such a CERCLA ("Superfund") will play a role which means that the landowner, mineral owner, injection operator and the entity that produced the CO_2 all may have some liability in perpetuity.

It's important to understand what this White Paper is not intended to accomplish. While it will identify a broad range of property and liability issues associated with injection projects, it will not suggest solutions to all of them. It will not address the range of liability issues associated with the high-pressure pipeline infrastructure necessary to move acid gases from the point of generation to the point of injection. For geologic CO_2 sequestration to become broadly viable there will need to be predictability on how these issues are handled. Many will have no predictable solution until and unless we have federal and state legislation.

[2] Acid gas injection for enhanced recovery of oil & gas is different from hydraulic fracturing which is also used to enhance recovery by physically opening the subsurface formations using very high pressure, proprietary formulas and particulates to hold the fractures open.

BACKGROUND

Much work has gone into the technical review of geologic CO_2 sequestration. (Frequently this is referred to more generically as carbon capture and storage or "CCS" – the remainder of this paper will utilize this nomenclature.) Some work has gone into potential regulatory programs based upon extensions of the current EPA Underground Injection Control ("UIC") program. EPA has proposed a regulatory approach which is the topic of a September 10, 2008 White Paper available to readers. (As nothing has really changed on this front, this White Paper will not cover that effort in any detail.)

Some states are adopting regulatory programs with various degrees of complexity. In general they are based upon existing UIC programs or on injection of "acid gas" for production enhancement in existing oil or gas operations. These can be radically different approaches and the internal political situation along with the perceived importance of the oil and gas industry has a large impact.

It is critical to distinguish between production enhancement injection programs and injection of CO_2 solely for sequestration purposes as they are radically different in intent, liability, risk and regulatory regime. A mineral owner typically has substantial rights to use techniques such as fluid injection in order to produce the "minerals" like natural gas and petroleum. Oil and gas production companies have substantial experience with this activity and tend not to view it as very risky even though it's currently benign regulatory posture is under attack.

As an example, the long-term liabilities associated with production enhancement versus CCS scenarios have substantially different legal postures. For example, a land owner or even an impacted neighbor may have products liability claims against the producer of the injected

enhancement fluid should it cause adverse impacts outside of the natural gas or petroleum production pool.[3] In a CCS project we would instead need to look to CERCLA or RCRA for guidance on long-term responsibility for the CO_2.

Not resolved to any satisfactory degree are the questions of legal access to property for the purpose of CCS, whether it is waste disposal or something else, liability for the entire host of things that people can imagine might go wrong, and long-term maintenance/monitoring. All one need do is examine EPA's 2008 Technical Support Document entitled "Vulnerability Evaluation Framework for Geologic Sequestration of Carbon Dioxide" to get a sense of the complexity of the problem and the difficulty of assessing potential risks.[4]

That these risks are a real concern when it comes to permitting and operation should be obvious. Some examples may help to illuminate the risks that the public will fear:

- Fluid injection is suspected of causing Texas earthquakes. *Wall Street Journal*, June 12, 2009, Page A3.
- Earthquakes caused by deep well injection of wastes at Rocky Mountain Arsenal. http://earthquake.usgs.gov/regional/states/colorado/history.php
- Crystal Geyser UT – CO_2 cold water eruptions through a manmade well. http://www.uweb.ucsb.edu/~glennon/crystalgeyser/
- 1986 Lake Nyos eruption and deaths.
- "CCS mobilization of hazardous, naturally occurring materials is a risk that must be characterized." "Injection into saline formations has the potential to disturb regional ground-water flow systems and could contaminate drinking water." Paraphrased from the testimony of Dr. Burruss, USGS, Subcommittee on Environment and Hazardous Materials, House Committee on Energy and Commerce, July 24, 2008

- Transportation infrastructure to transport CO_2 to injection sites does not exist – USGS projects that an infrastructure larger than the existing natural gas/petroleum industry will be required to achieve meaningful levels of CCS. http://energy.er.usgs.gov/health_environment/CO2_sequestration/CO2_illustrations.html

[3] See Modesto, City of v. The Dow Chemical Co., et al., No. 98-999345, Calif. Super., San Francisco Co. (liability based on products liability theories found for dry cleaning fluid off-site impacts)

[4] http://www.epa.gov/climatechange/emissions/downloads/VEF-Technical_Document_072408.pdf

ISSUES and DISCUSSION

I. Liability During Injection / Operational Liability

Operational liability includes the environmental, health, and safety risks associated with CO_2 capture, transport, and injection. Enhanced fluid recovery contractors are already subject to a duty of care defined under tort law and are usually subject to standards of conduct under their contractual arrangements. Companies providing these specific services have experience in their industries, and are subject to liability for worker safety and property damage resulting from their conduct. These companies are best positioned to manage the risks associated with their own conduct and are able to obtain liability insurance for their conduct and workers.[5] In surveys and case studies, these companies were willing to provide services on a commercial basis and generally willing to accept liability for their actions.[6]

However, it is foreseeable that large-scale CCS could make it less likely that companies will be willing to accept liability for injection. For example, if there was contamination at the surface during injection operations it could potentially affect drinking water. There is currently no law protecting commercial or public operations from the full range of liabilities should they cause contamination.

In theory government agencies could conduct the injection operations to limit liability associated with injection. An example of this is Lawrence v. Buena Vista Sanitation District.[7] Neighbors brought a trespass claim against the sanitation district, alleging contamination from leakage at the district's wastewater treatment facility but did not argue that negligence was

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[5] M.A. de Figueiredo, D.M. Reiner, H.J. Herzog, *Towards a Long-Term Liability Framework For Geologic Carbon Sequestration*, Presented at the Second Annual Conference on Carbon Sequestration, Alexandria, Va. May 2003.

[6] Craig A. Hart, *Advancing Carbon Sequestration Research in an Uncertain Legal and Regulatory Environment: A Study of Phase II of the DOE Regional Carbon Sequestration Partnerships Program*, Discussion Paper 2009-01, Cambridge, Mass.: Belfer Center for Science and International Affairs, January 2009 (finding drilling companies willing to participate in CCS and accept liability for their actions).

[7] Lawrence v. Buena Vista Sanitation Dist., 989 P.2d 254 (Colo.App. 1999)

present. The court held that the district was immune from a trespass claim under Governmental Immunity Act "unless negligence is proven". Trespass is not a dangerous condition of a public water facility or public sanitation facility; because the trespass claim did not require proof of negligence it was barred by Governmental Immunity. Nobody should take this sort of outcome as an indication that government agencies can conduct these operations with impunity – there are many other available theories of liability.

II. Post Injection Liability

A. Ownership of Pore Space

The surface owner usually owns pore space because mineral conveyances, including leases, normally only pass title to the minerals, not the pore space itself. That does not, however, end the conversation over who controls the pore space property right. The surface owner cannot violate the mineral estate owner's or lessees' rights by doing something interfering with access to the minerals, making the minerals more expensive to exploit or making the development of the minerals economically impractical. Clearly injection into the pore space could cause this sort of harm. The surface owner must also allow reasonable use of the property to give access to the mineral estate.[8] For CCS projects to proceed it is somewhat reckless to assume that agreement with the surface owner is the only necessary step. It seems prudent to have agreements with both surface and mineral owners even though it seems likely that the surface owner owns the pore space.[9]

B. Risk of Leakage

Post-injection liability includes harm to human health, the environment, property, and the climate liability related to leakage or migration of carbon dioxide from geological reservoirs and

[8] Cassinos v. Union Oil, 14 Cal.App.4th 1785 (1993)

[9] *Geologic CO2 Sequestration: Who Owns the Pore Space*?, 9 WY LR 98, 2009.

the effect on climate change. Potential pathways for carbon dioxide release include leakage through the pores of low-permeability cap rocks if the carbon dioxide is injected at too high a pressure, leakage through openings in the cap rock, leakage through abandoned or improperly sealed wells, and migration via faults.[10]

Reportedly, there is a low risk of captured carbon leaking into the atmosphere in amounts significant enough to pose a risk.[11] CO_2 and natural gas has been stored naturally in geologic formations for millions of years and companies already store natural gas underground with a lot of experience. There are naturally occurring CO_2 reservoirs in the western states that have held gas for millions of years. Furthermore, over 100 million tons of CO_2 has been injected into oil reservoirs for enhanced fluid recovery as well as into deep saline aquifers (over 80 projects have been implemented worldwide).[12] Commercial and experimental projects have shown the potential for CCS across a wide range of geological settings.

There are, however, reports suggesting that an exceptionally detailed analysis of geologic conditions is critical to understanding how the CO_2 is being sequestered in each case. Whether CO_2 is being mineral trapped, in which case it may be stable on geologic time scales, versus dissolution in groundwater is critical to an assessment of whether a potential for leakage is present. Dissolution in groundwater is not preferred as it has the greatest potential for eventual leakage to the atmosphere.[13]

The long-term liability associated with CO_2 leakage that damages health or property is difficult to establish because it is dissimilar to other regulatory schemes and has a timeframe of thousands of years. We simply do not know what risks long-term geologic storage presents.

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[10] IPCC, IPCC special report on carbon dioxide capture and storage; 2005.

[11] Feidman, This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344

[12] Rocky Mountian Mineral Law Institute

[13] Aeschbach-Hertig, Clean Coal and Sparkling Water, NATURE, Vol 458, Page 583, April 2009.

Exposure to CO_2 typically is not dangerous except in very high concentrations (> 15,000 ppm). For example, in Lake Nyos 1,500 people died when a lake over a magma pool released large amounts of CO_2. This is unlikely to occur at injection wells when properly monitored. Researchers have successfully plugged and abandoned CO_2 injection wells, even badly damaged and failed wells. In wells that have failed and released CO_2, almost all were detected quickly and stopped.[14]

EPA produced a July 2008 white paper entitled *Approaches To Geologic Sequestration Site Stewardship After Site Closure*.[15] They describe the advantages and disadvantages of stakeholder developed models as well as models based upon existing federal laws ranging from the Nuclear Industries Indemnity Act through CERCLA. If CCS is viewed as waste disposal the "cradle-to-grave" model of the RCRA and perpetual nature of liability under CERCLA would be inconsistent with any effort to limit responsibility for injected CO_2 and especially any potentially hazardous contaminants entrained in the injected materials.

EPA's analysis has been criticized as unrealistic given that geologic storage of CO_2 is intended to be indefinite and well beyond 50 years. The authors of a recent report view this as the single greatest legal obstacle to commercial deployment of CCS.[16] Quite obviously, legislation will be required to address this issue if there is to be any time limit on liability.

C. Property Rights Issues Related to Migration of Injected CO_2

1. Natural Gas Storage Law May Provide Some Insight

[14] S. Julio Friedmann, Carbon Management Program APL Global Security Principle Directorate, LLNL. .S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344

[15] http://www.epa.gov/OGWDW/uic/pdfs/support_uic_CO2_stewardshipforsiteclosure.pdf

[16] World Climate Change Report, 87 WCCR, 05/08/2009, BNA.

Gas that is injected for storage remains the property of the injector.[17] Injection of gas into property that the injector does not own is a trespass.[18] Pore space for such projects can be purchased or leased from the landowner, and/or the mineral estate owner, so long as it does not damage other persons.[19] Agreement with the mineral estate owner or lessee will generally be prudent in order to avoid later damage or trespass claims as there is ambiguity in some states regarding whether a mineral owner owns the pore space previously occupied by the minerals, natural gas or petroleum they have removed.[20] Liability for negligent operation of storage operations exists.[21]

Under many federal and state laws utility companies have eminent domain rights for utility facilities. This begs the question of whether CCS operations represent a utility facility under these statutes – if viewed as waste disposal, there is doubt. These statutes do not address the ability to exercise eminent domain rights over buffer zones that may be desirable because of the potential for gas migration. Buffer zones should be included because gas escape is a trespass; however, how such a buffer might be valued in an eminent domain action is unknown.

With regards to carbon sequestration the concept of condemnation poses several problems. CCS potentially involves large areas of land – hundreds of acres - depending upon the subsurface conditions and resulting available storage volumes.[22] The uncertainty over whether statutory authority to exercise imminent domain applies suggests an initial effort to negotiate and purchase rights. If injection requires approval from any landowner that could be affected, then it

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[17] Ellis v. Arkansas Louisiana Gas Co., 450 F. Supp. 412, 419 (D.C. OKL 1978) and many others

[18] Kuntz, The Law of Oil and Gas s 2.6, p.71

[19] Ellis, at 450 F. Supp. 412

[20] *Geologic CO2 Sequestration: Who Owns the Pore Space*?, 9 WY LR 98, 2009.

[21] In a recent case from Louisiana a jury awarded $9.2M to a petroleum company whose ability to exploit reserves was adversely impacted by improper maintenance and operation of a neighboring salt dome storage facility.

[22] *Separation and capture of CO2 from large stationary sources and sequestration in geological formations--coalbeds and deep saline aquifers. J Air Waste Manag Assoc. 2003 Jun;53(6):645-715*

will be necessary to secure consent from a potentially large number of people. Negotiation and condemnation will therefore impose high costs and long acquisition times.

As it will not be the intent (in most cases) to later retrieve the gas, there are interesting questions and serious unknowns regarding the rights and duties of the property owners later in time. Establishing ownership of CO_2 in perpetuity is a key part of this problem, especially given the vast amounts of time it will be sequestered. If there is no intent to recover perhaps there is no duty to protect and preserve the CO_2 or the associated surface facilities. If the entity that owned the CO_2 when it was injected disappears, then whether the CCS process is waste disposal or something else will be critical to understanding the on-going duties of the landowner. Any resolution of this issue will require legislation.

2. Enhanced Oil Recovery

Oil and gas leases typically contain the right to inject fluids to aid in the production of gas or oil, but not for disposal of waste. Leases and state laws often give the producer the right to "unitize" for secondary recovery allowing injection in various locations of a field. These enhanced recovery efforts are not necessarily designed to sequester CO_2 even if "acid gas" is used. Given the lease/contract rights these processes are probably not a good mechanism to examine the broader liability issues associated with CCS projects unassociated with oil and gas production.

As noted before liability for the injected materials, such as hydraulic fracturing fluid or acid gas, exists regardless of why these materials were injected. Contract or lease theories will apply and may be of value in the short-term until the normal statute of limitations runs. Beyond these theories liability is likely perpetual under federal environmental laws as these fluids will

typically contain hazardous substances. As noted earlier, products liability theories may apply to the entity that produced the fluid if it harms third persons.

3. Waste Injection

Wastewater wells are subject to permitting by EPA and/or states. Failure to obtain permits or operate within the terms of a permit will make the operator subject to agency enforcement and citizen suits. Obviously the party injecting must have the legal right to do so; however, what those rights mean will be highly variable. In Chance v. BP Chemical, the Supreme Court of Ohio determined that the defendant committed a trespass when chemicals injected underground migrated under plaintiff's property for which no rights had been acquired. Even so, the proper evaluation of damages is very uncertain.

The court held that the surface owner's rights were not absolute, but were contingent on the reasonable and foreseeable use of their property.[23] According to the court, subsurface rights include the right to exclude invasions of the subsurface property that actually interfere with the property owner's reasonable and foreseeable use of the subsurface.[24] This would most certainly include harm to minerals or oil and gas resources leased by the landowner.

This sort of analogy would work well for CCS because landowner's that are not harmed by stored CO_2 would have no cause of action. It seems to follow that there would only be a cause of action after CO_2 specifically damages the health or property of a landowner – not for speculation that gas could potentially leak from geologic formations or interfere with access to minerals or oil and gas. Many courts would likely disagree and would find diminished value simply due to the trespass. Legislation, rather than litigation, is by far the best way to establish the rules in this arena.

[23] Chance v. BP Chemical, 1995 WL 143827 (Ohio Ct. App 1995)
[24] Id.

4. Wastewater

In Cassinos v. Union Oil Co., the owners of a mineral estate sued defendant for damages when defendant injected wastewater into the mineral estate. The California Appeals Court rejected the defendant's claim that it should not be liable because the plaintiff did not establish the extent of damage to the mineral estate. The court held that there was substantial evidence the defendant's actions interfered with and damaged the mineral estate. Therefore, the defendant committed a trespass. The court also held that the plaintiff in the case could waive the tort claim and collect on an alternative theory of contract implied in law to recover the value of the use taken.[25]

From Chance (supra) and Cassinos, it is apparent that a cause of action is not likely to occur if there is no damage done. Interference with mineral rights should be a concern because CCS can displace subsurface gases and groundwater, which could damage mineral estates. The holder of a mineral estate or lease would have a cause of action along with the surface owner.

If the activity is allowed by statute it does not necessarily mean that the injector will be absolved of liability. In Tidewater Oil Co. v. Jackson, there were damages to plaintiffs' oil wells as a result of water flooding operations conducted by defendant on adjoining property. The Court of Appeals held that where defendant's water flooding activities were intentional and damage to wells on adjoining land was foreseeable, defendant was liable under Kansas law for damage to wells of adjoining leaseholders.

These findings were inconsistent with the administrative findings to the effect that the water flooding operations were carried on in a lawful manner. In the view the court took, it was unnecessary to reconcile the findings. It was sufficient that the water flooding activities were intentional and the consequences foreseeable. A legal claim was available, even though the

[25] Cassinos v. Union Oil Co., 14 Cal.App.4th 1770, 18 C (Cal App 1993)

flooding was lawfully carried on, because it caused substantial injury to the claimants.[26] This case is important because it highlights that regulations that allow CCS may not absolve the defendant of common law property law liability.

4. Water Law

It most of the Western US surface and groundwater is a public resource dedicated to the beneficial use of public agencies and private persons wherever they might make beneficial use of the water. (Texas is a bit different in that groundwater belongs to the landowner and is not subject to prior appropriation. That can result in significant fights between neighbors should one pump so much groundwater that a neighbor's well becomes dry. This law of the "biggest pump" has been mitigated through administrative processes such as conservation districts regulating the use of groundwater.[27]) Under the general western approach, including surface water in Texas, water quality and quantity are property rights subject to statutory and common law protections. The biggest difference between water and real property is that the protections available for water frequently exceed those available for real property.

The right of water use includes the right to cross the lands of others to place water into, occupy and convey water through, and withdraw water from the natural water bearing formations within the state in the exercise of water use right. Natural water bearing formations may also be used for the transport and retention of water.[28] Water authorities can inject water for later withdrawal with no payment for the pore space. The property rights of landowners or mineral estate owners/lessees do not include the right to control the use of water in the ground and cannot claim control of aquifers as part of their estate. Except for Texas, groundwater is part of "waters of the state" and either by Constitution or statute, the general assembly of each state

[26] Tidewater Oil Co. v. Jackson, 320 F.2d 157 (C.A. Kan. 1963)

[27] *Sipriano v. Great Spring Waters of America, et al., 1 SW3d 75* (Texas 1999)

[28] Board of County Com'rs of County of Park v. Park County Sportsmen's Ranch, 45 P.3d 693, 706 (Colo. 2002)

has control over the use and disposition of groundwater regardless of whether it is or is not directly discharged to a natural stream.

The law in most states prohibits the taking of private property for public or private use without the property owner's consent, but there are frequently exceptions which pertain to constructed water facilities.[29] For example many western state constitutions provide for access to the water source across the lands of others and further recognize and address the private right of condemnation for the construction of waterworks.[30] There is a requirement for compensation for use of another's land, but that does not extend to employment of natural water bearing subsurface formations on or within the landowner's property for the movement of appropriated water.[31] An applicant for a conditional decree to utilize available aquifer storage space must demonstrate that it will capture, possess, and control water lawfully available to it and without injury to other water rights.[32]

Water storage under a landowner's property is not a trespass if it does not inhibit the use, benefit, or enjoyment of property.[33] In Board of County Commissioners v. PCSR, LLP, PCSR proposed to store water in underground aquifers underlying approximately 115 square miles. The landowners claimed that storage of water underground in aquifers underneath their land would constitute a trespass. The Court held that it would not be a trespass and the project would not require the Landowner's consent or condemnation and the payment of just compensation under the provisions of Article XVI. The court, in applying Causby,[34] found that the project did not include construction of any facilities on or in the Landowner's properties and the

[29] Colo. Const. art. XVI § 7
[30] Colo. Const. art. II § 14
[31] Sportsmen's Ranch, at 45 P.3d 708
[32] Id.
[33] Sportsmens's Ranch, 45 P.3d at 708
[34] U.S. v. Causby, 328 U.S. 256 (1946) (ruled that property owner's rights were not unlimited with respect to airspace).

Landowner's had not alleged that the use, benefit, and enjoyment of their properties would be invaded or compromised in any way. Therefore, it was not a trespass.

The court stated that the General Assembly, in authorizing the use of aquifers for storage of artificially recharged projects further supplanted the Landowners' common-law property ownership theory.[35] The court found it "particularly [significant]" that:

> (1) [F]ederal patents to land do not include water, (2) ground water is not a mineral under the federal mining laws …, (3) federal statutes as interpreted by the Supreme Court recognize [a state's] authority to adopt its own system for the use of all waters within the state in accordance with the needs of its citizens, subject to the prohibitions against interference with federal reserved rights, with interstate commerce, and with navigability of any navigable waters, (4) the right of prior appropriation applies … to waters of the natural stream, including surface water and tributary ground water; (5) the property rights of landowners do not include the right to control the use of water in the ground, whatever the character of that water; and (6) the General Assembly has plenary control over the use and disposition of ground water that is not part of the natural stream.[36]

In sum, the holders of water use rights may employ underground as well as surface water bearing formations in the state for the placement of water into, occupation of water in, conveyance of water through, and withdrawal of water from the natural water bearing formations in the exercise of water use rights.[37] Consent or just compensation was not required because the plaintiffs did not have the right to restrict the defendant's use of the water that was done within regulations.

CCS presents a unique problem because the underground storage of CO_2 could potentially affect the flow and location of groundwater. This could occur because the process of physical trapping may displace naturally occurring water and other gases.[38] Any effect on water resources could pose potential liability if it limits access to water that has already been

[35] Id. at 703
[36] Id.
[37] Id. at 712
[38] Statement of Dr. Robert Burrus, Research Geologist, Enerby Resources Team U.S. Geological Survey U.S. Dep. Of the Interior Before the Subcommittee on Environement and Hazardous Materials House Committee on Energy and Commerce Hearing on "Carbon Sequestration: Risks,

appropriated to beneficial use. Physical displacement of groundwater can also have adverse practical impacts on private owners and utilities. As a result it will normally be prudent to evaluate whether on-site groundwater wells, especially those used by public water systems, will be disrupted by CCS operations.

In most places a water right includes the right to a particular quality as well as a particular quantity of water. These cases are typically framed in the context of deprivation of quantity but these water rights are also protected from activities of another that injure the quality of a water right.[39] Therefore, if water quality is affected by the precipitate that hopefully forms from the geochemical reactions intended as part of CCS operations the owner of that water could have a cause of action against the entity injecting and the owner of the gas injected. Historically such interference involved the discharge of mine and other wastes into the stream but there is no reason to believe the result would be different with CCS.[40]

III. Regulation

A. EPA UIC Rulemaking

The UIC Program regulates underground injection under five different classes of injection wells, depending on the type of fluid being injected, the purpose for injection, and the subsurface location where the fluid is to remain. States are allowed to assume primary responsibility for implementing the UIC requirements in their borders, as long as the state program is consistent with EPA regulations and has received regulatory approval. Injection operators are required to provide financial assurance in case they cease operations, with the level of assurance a function of the estimated cost of plugging and abandoning the injection well. If there is a violation of a UIC permit, an enforcement action may be brought by the EPA

[39] 2A COPRAC § 76.11

[40] Game & Fish Comm'n v. Farmers Irr. Co., 162 Colo. 301, 426 P.2d 562 (1967); Wilmore v. Chain O'Mines, 96 Colo. 319, 44 P.2d 1024 (1934).

Administrator or the applicable state agency. Violators may be subject to administrative orders, civil penalties, and criminal penalties. The scope of the UIC statute is contamination of drinking water, and under its current application to CO_2 storage, the UIC Program gives more limited treatment, if any, to other harms to human health, the environment, and property.[41]

While there are requirements for constructing and monitoring injection well operation, there are no federal requirements for monitoring actual movement of fluids within the injection zones, nor are there requirements for monitoring in overlying zones to detect leakage with the exception of specific class I hazardous wells, where this monitoring can be mandated.[42]

On July 15 2008, the EPA proposed a rulemaking package that would regulate geologic sequestration of carbon dioxide under the UIC. The proposed rules would create a new category of UIC well (Class VI) designed specifically for injection of CO2 into geologic formations. The proposal includes detailed technical requirements for characterizing the scope and suitability of the target formations, assuring that the injection zone will not affect any actual or potential source of drinking water, monitoring and reporting on well conditions during and after the sequestration is complete, and requiring as part of well permit applications plans for 50 years of post-injection monitoring.[43]

The proposed rules do not directly address air quality issues. The Class VI CO_2 injection well requirements are designed to assure that there are no significant releases of CO_2 or contaminants in the CO_2 into the ambient atmosphere. The EPA declined to classify CO_2 as a hazardous waste but the proposed rules place a burden on the permittee to assure that the CO_2 does not contain impurities that would trigger RCRA hazardous waste management

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[41] Craig A. Hart, *Advancing Carbon Sequestration Research in an Uncertain Legal and Regulatory Environment: A Study of Phase II of the DOE Regional Carbon Sequestration Partnerships Program*, Discussion Paper 2009-01, Cambridge, Mass.: Belfer Center for Science and International Affairs, January 2009.

[42] Regulating the ultimate sink: managing the risks of geologic CO2 storage. Page 3479

[43] http://www.epa.gov/ogwdw/uic/wells_sequestration.html

requirements. The risks associated with this classification are manifest. Injection of hazardous waste is highly regulated and would likely bring a CCS project to a screeching halt.

None of this overrides the applicable provisions of CERCLA or RCRA. To the extent there are hazardous substances released from the sequestration process liability under CERCLA may be present.[44] Likewise if materials injected are hazardous waste the daunting permitting and corrective action provisions of RCRA and the state programs will apply.

As an example, EPA issued orders under RCRA to require management of propane that had leaked from an underground distribution system. In EPA's view, the moment the propane leaked from the distribution system it was a waste and presented a hazard. Depending upon the factual setting, CCS operations could find themselves in the same situation.

B. State Regulation

In the absence of federal action on the carbon sequestration issue, many states are in the process of enacting their own regulations. Some examples follow:

1. Wyoming

House Bill 89 (created Wyoming Statute § 34-1-152 and amended Wyoming Statute § 34-1-202) addresses the ownership of Pore Space. The Bill establishes that the surface owner owns pore space underneath the surface estate and that the pore space is conveyed upon the conveyance of the surface, unless the space has been previously conveyed or is explicitly excluded in the surface conveyance (in the same manner as a mineral interest). In addition, legal requirements for notice to surface owners and/or mineral interest owners shall not be construed to require notice to the pore space owner unless the law specifies that such notice to the pore space owner is required. The statute expressly recognizes the dominance of the mineral estate

[44] http://www.hhclimatechange.com/climate_change/2008/07/epa-releases-pr.html

and does not alter the common law as it relates to the rights of the mineral estate. The bill states explicitly that it does not affect the common law regarding the dominance of the mineral estate.[45]

House Bill 90 (effective July 1, 2008; created Wyoming Statute §§ 30-5-501 and 35-11-313 and amended Wyoming Statute § 35-11-103(c)) mandates UIC permit for GCS. It makes a clear distinction from EOR. It instructs the Wyoming Department of Environmental Quality to establish and issue permits to new "sub-classes of wells" within the UIC program and to regulate well standards, bonding and monitoring. The bill requires the DEQ to create an advisory board and rules to expand the UIC program to include carbon sequestration. Under the bill, a working group including the supervisor of the oil and gas commission, the state geologist, and the director of the DEQ will set bonding procedures. Jurisdiction subsequent extraction of sequestered carbon dioxide rests with the Wyoming Oil and Gas Conservation Commission. The bill does not impact the oil and other mineral interest owners' right to drill or bore through sequestration sites, nor does it include within its scope the regulation of enhanced oil recovery operations using carbon dioxide.[46]

Like HB 89, Wyoming's carbon capture and sequestration legislation recognizes the continuing dominance of the mineral estate. § 30-5-501 states specifically that the carbon sequestration legislation enacted by § 35-11-313 shall not "affect the otherwise lawful right of a surface or mineral owner to drill or bore through a geologic sequestration site" so long as the drilling is conducted in conformity with rules for protecting the sequestration site against the escape of CO_2.[47]

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[45] Id. at 143-45

[46] Delissa Hayano, *Guarding the Viability of Coal & Coal-Fired Power Plants: A Road Map For Wyoming's Cradle to Grave Regulation of Geologic CO2 Sequestration*, 9 *Wyo. L. Rev.* 139, 145-49 (2009)

[47] Id.

2. Oklahoma

Senate Bill 1765 (May 2008) was a proposal that required the development of GCS permitting regime and transferred ownership of wells to state and released owners from liability 10 years after closure. The Bill that was passed, however, was relatively disappointing. It mandated a task force to report to the Governor with GCS permitting recommendations by December 2008 (extended to December 2009) and is modeled based on the IOGCC model statute.[48]

3. Kansas

Under HB 2419 (2007), GCS rules were supposed to be developed by July 2008 (draft in progress). Under the Bill, a state GCS fund would pay long-term GCS related monitoring and remedial activities. It also exempts GCS property and any electric unit utilizing GCS from taxes for 5 years. Finally, it allows for accelerated depreciation of GCS equipment.[49]

4. Washington

ESSB 6001, passed April 17 2008. It codifies the emissions-reduction goals and policy recommendations for the state. The bill also sets an Emissions Performance Standard (EPS) that limits electric utilities' ability to sign new or renewed long-term contracts with power plants whose greenhouse-gas emissions exceed those of a modern natural gas-fueled power plant. The bill essentially ends construction of pulverized coal plants to serve Washington loads, makes the price of IGCC power reflect some of its emissions disposal costs, and jumpstarts the process toward a comprehensive greenhouse-gas emissions reduction plan for the state.[50]

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[48] de Figueiredo MA, Reiner DM, Herzog HJ. Framing the long-term in situ liability issue for geologic carbon storage in the United States. Mitigation Adapt. Strat. Global Change 2005;10:647-57.

[49] Melisa F. Pollak ,Humphrey Institute of Public Affairs, Big Sky Carbon Sequestration Partnership Annual Meetin. Oct. 28, 2008

[50] NW Energy Coalition, April 19, 2007. www.nwenergy.org/publications/fact-sheets/6001%20FINAL%2