GROUNDWATER PROTECTION COUNCIL

An Assessment of State Needs for Regulating Geologic Sequestration of Carbon Dioxide

U.S. DEPARTMENT OF ENERGY

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Preface

Geologic storage of carbon dioxide—or CO_2 geosequestration—is among the technologies widely under consideration by policymakers in formulating climate change mitigation strategies. State regulatory oversight of CO_2 geosequestration is a prerequisite to successful application of this technology; yet developing and implementing such regulatory programs has the potential to cause hardships for responsible state agencies. Recognizing this concern, the U.S. Department of Energy contracted with the Ground Water Protection Council (GWPC) to assess the needs for regulating large-scale geosequestration at the state level.

The Underground Injection Control (UIC) program, expected to be the resident instrument for implementing the U.S. Environmental Protection Agency's sequestration regulatory program, has provided the framework for the safe and effective isolation of fluids injected underground for 30 years. While the federal share of program implementation costs was approximately 75 percent in the initial five years of the program, the UIC primacy states have had to bear an increasingly larger share of these costs in subsequent years, to the extent that most states now carry a 65- to 75-percent share.[1]

The primary purpose of this report is to lay a foundation for states to accurately project additional personnel and associated costs and supporting capital outlay for a Class VI primacy program for "large-scale" geosequestration. Volumes of CO_2 injectate are a key factor in determining the size of the "Area of Review" to be evaluated in the permitting process for a geosequestration project. While peer-reviewed literature does not currently support a consensus definition of "large-scale" geosequestration, the Sleipner Gas field geosequestration project (shown here) operated by StatOil® in the North Sea is often cited in the literature as a "large-scale" project. Sleipner injects about 1 million metric tonnes of CO_2 annually, a metric that will be used for defining "large-scale" geosequestration for purposes of this needs assessment.

Since the sole purpose of the UIC program is the isolation of injected fluids from Underground Sources of Drinking Water (USDWs), only the injection and containment of CO_2 can be regulated under the UIC program. It is not designed to address ancillary issues such as air emissions, pore space ownership, or carbon credit accounting. These non-UIC issues will need to be addressed and could result in additional cost to the state regulatory regime if state legislatures decide to include them in the CO_2 sequestration program.

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Scott Anderson, Environmental Defense Fund (EDF)
Mark Bohrer, North Dakota Industrial Commission (NDIC)
Bill Bryson, Kansas Geological Survey (KGS)
Arthur Hartstein, HartWorks (private consulting)
Theresa Pugh, American Public Power Association (APPA)
Mike Nickolaus, Ground Water Protection Council (GWPC)
John Veil, Argonne National Laboratory (ANL)
Paul Jehn, Ground Water Protection Council (GWPC)

Executive Summary

The process of storing or sequestering CO_2 in the subsurface (geosequestration) will involve the development of a regulatory framework capable of ensuring injected CO_2 does not migrate into Underground Sources of Drinking Water (USDWs) or return to the atmosphere. The framework must take into account the unique characteristics of super-critical CO_2, such as buoyancy, while also addressing special requirements for containment within complex geologic settings. These challenges will require the development and implementation of regulatory systems that can extend the capacity and capability of existing Underground Injection Control (UIC) programs to include new activities such as long-term liability, monitoring measuring and verification, and three-dimensional modeling of large volumes of injectate.

In assessing the needs of state regulatory programs, the Ground Water Protection Council (GWPC) selected six state programs from twenty state survey questionnaire responders for follow-up interviews. Their responses were reviewed and analyzed to provide a baseline inventory of current program resources. GWPC also reviewed state activities to determine the current status of CO_2 geosequestration regulatory development, finding that each of the six states was in a different phase of regulatory development. These phases ranged from states with no current or proposed CO_2 geosequestration program (Michigan), to those with statutory authority and proposed regulations (Texas and Wyoming), to Kansas, where regulations have been adopted pursuant to a legislative directive from 2007. A description of the study methodology and design, as well as a summary of the interview responses, can be found in Appendices A and B. The questionnaire responses and an analysis of follow-up survey results by state can be found in the Addendum.

In general, states must address several areas of need in order to accomplish efficient and effective regulation of geosequestration under the federal Class VI regulation:

1. **State primacy delegation**. The EPA has decided to delegate primacy for the Class VI program separately for Class VI wells only. This determination means states that do not have primacy under Section 1422 of the SDWA will be allowed to seek primacy for the Class VI program without being required to take primacy for Class I, III and V wells at the same time. Regardless, there are still several factors that will need to be addressed by states with respect to primacy. For example, states will be required to submit primacy applications within 270 days of the effective date of the federal rule. Also, EPA has specified that agencies with Section 1422 primacy may continue to issue permits for geosequestration under their Class I and V programs but these will have to be re-permitted as Class VI within 365 days after the agency acquires primacy for the Class VI program. Another item affecting Class VI delegation is a specification in the new rule requiring the submission of several new types of plans that have not been required in previous UIC program primacy applications. However, EPA has acted in some ways to assist states with respect to primacy. For example, EPA is going to allow states to submit primacy applications electronically. Also, EPA is developing a manual on primacy for states to use and is holding training sessions on the new rule which include information about primacy delegation.

2. **Staffing and funding upgrades**. The current federal UIC program has been funded at approximately $10.5 million for more than 20 years. Based on an analysis of expected staffing needs for states to implement the Class VI program, UIC funding may need to be increased by as much as $75 million

annually to effect full implementation. Additionally, demand for qualified professionals by industry will likely result in a shortage of available personnel in state UIC agencies, whose salaries typically cannot compete. If geosequestration regulation programs grow as many predict, lack of staff availability may be exacerbated and could result in substantial delays in permitting of projects.

3. **Data management systems**. Although all study states have UIC data management systems, additional elements will be required to track the specific information needed for implementation of a geosequestration program. These additions may result in a need to expand data storage, reporting, handling, entry, and other related capacity. Furthermore, since electronic reporting may become necessary to handle the immense amounts of data in geosequestration regulatory programs, EPA requirements under the Cross Media Electronic Reporting Rule (CROMERR) may slow down efficient program implementation in states that are not CROMERR compliant.

4. **Public outreach programs**. Most states utilize a public participation system that relies on the filing of complaints and formal hearings to address concerns in accordance with administrative procedures acts. Given the special characteristics of geosequestration, such as project size, it will be important for states to become more proactive in obtaining public input into regulatory decisions. This will involve using techniques such as holding public meetings, maintaining websites, and conducting mass e-mailings in advance of project permitting. Failing to modernize methods of communicating with the public could result in substantial push-back from the public and slow down the implementation process.

5. **Training programs**. Technical and programmatic training will play a significant role in the implementation of geosequestration regulations. Most states utilize on-the-job training in combination with some formal training such as the EPA's Inspector Certification Course and attendance at GWPC technical forums. Due to the complex nature of the geologic and engineering knowledge required to permit and manage geosequestration projects, a formal technical training program for permitting and field staff will be essential. Additionally, permittees will need programmatic training to assure they understand the state program procedures for permitting, financial assurance, imposed conditions of operation, monitoring, measuring and verification techniques, and site closure and monitoring requirements.

Background

Carbon dioxide (CO_2) is one of several gases produced by industrial processes, vehicle emissions, and natural processes such as animal respiration and plant activity that are believed to be contributing to the volume of anthropogenic greenhouse gas emissions and to be raising the overall temperature of the atmosphere. Developing technologies, processes, and programs for reducing emissions of greenhouse gases such CO_2 without causing a different set of environmental problems is considered an important part of any strategy for mitigating climate change.

Several technologies have been suggested for sequestering CO_2, including ocean storage, terrestrial storage, and geologic storage, often called geosequestration. Of these, only geosequestration can be regulated through the framework of a longstanding federal environmental program. This program, Underground Injection Control (UIC), is part of the Safe Drinking Water Act of 1974 and has a long history of successfully isolating materials below Underground Sources of Drinking Water (USDWs) in the subsurface. EPA implementation of UIC began with promulgation of Section 1422 regulations in 1980. Subsequently, with the inception of primary delegation in 1982, the UIC program has been widely delegated to the states.

Research into the ability to safely and effectively inject CO_2 into the subsurface has been ongoing for several years. The U.S. Department of Energy (DOE), through the National Energy Technology Laboratory (NETL), established seven Regional Geosequestration Partnerships, as shown in Figure 1, to conduct research into geosequestration technology. The Regional Partnerships have conducted numerous tests of CO_2 injection at smaller field testing sites and are currently working on projects to inject CO_2 on larger, demonstration scales. These efforts have yielded substantial scientific and technical knowledge about the behavior of CO_2 in the subsurface. Each of these partnerships works closely with a university or universities in their region. For example, the Southwest Partnership (SWP) is aligned with the Texas Bureau of Economic Geology at the University of Texas at Austin, Jackson School of Science. The SWP is currently conducting demonstration-scale geosequestration projects in oil and gas reservoirs and coal seams in Texas, Utah, and New Mexico and has proposed a full-scale test in Utah. In addition to the partnerships, national laboratories such as Lawrence Berkeley National

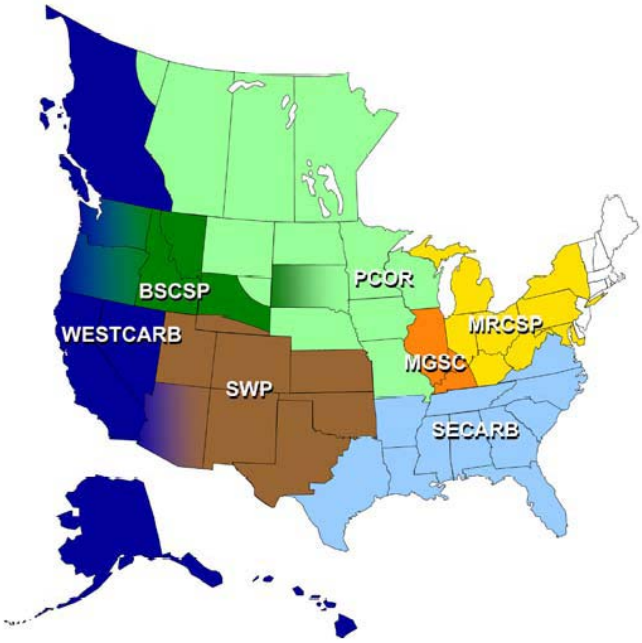


Figure 1: Regional Geosequestration Partnerships

Laboratory have been involved in research in areas of geochemical and geomechanical effects of geosequestration. Regardless, challenges lie ahead as researchers begin to undertake and evaluate the results of full-scale geosequestration testing.

Why an Assessment of State Needs Is Critical

Establishing effective regulatory oversight is as vital to successful geosequestration programs as addressing the scientific, technical, legal, and fiscal prerequisites. Regulatory programs will be used to ensure geosequestration is conducted in a manner that:

- Protects USDWs
- Allows for and facilitates flexible approaches to implementation as new technology becomes available and is proven viable
- Provides for appropriate monitoring of long-term underground storage of CO_2
- Minimizes the risk of CO_2 releases back to the atmosphere
- Facilitates implementation of geosequestration.

While substantial efforts have been made by industry, private research entities, and academia to identify the scientific and technical needs associated with geosequestration, far less attention has been paid to the companion regulatory systems. Organizations such as the World Resources Institute (WRI)[2] and the Carbon Capture and Sequestration Regulatory Project (CCSReg)[3,4] have conducted valuable research into regulatory needs by identifying issues and making recommendations relative to those issues. However, these efforts did not include participation of the state agencies, which will implement geosequestration regulation, nor did they estimate regulatory resource needs such as staffing and funding. An examination of such needs is critical to the development of functional regulatory programs capable of handling the technical, legal, and administrative aspects of geosequestration.

Potential Barriers to Large-Scale Implementation

Several barriers must be overcome before large-scale implementation of geosequestration is feasible. These barriers include technical knowledge, implementation costs, environmental concerns, property rights issues, financial assurance concerns, information management capability, and regulatory capability and capacity.

Technical knowledge

A barrier to large-scale geosequestration programs may be created where industry is unwilling or slow to keep regulators apprised of new technologies as they are developed to the point of implementation, or where state or federal regulations are so procedurally restrictive that new technologies cannot be permitted without an exhaustive approval process. A barrier also may be created if the regulatory agency is reluctant to accept new technologies because of unfortunate historical experience. Regulators may be reluctant to act when:

1. Innovations are viewed as economically driven rather than environmentally protective
2. Changes would require the agency to undergo an onerous regulatory amendment process
3. Inclusion of new technologies may require the state to amend their primacy agreement with EPA.

Implementation costs

The cost of regulating geosequestration may be a significant barrier to overcome for some state programs. The sheer scope of regulating geosequestration due to the potential volume of injected CO_2 and numbers of wells/projects could be orders of magnitude larger than the total existing Class I UIC program. There are approximately 523 Class I wells in operation nationwide and the total volume of injectate into these wells annually is about 9 billion gallons.[5] The cost to a state to efficiently regulate these wells depends on the continued ability of injection formations to receive fluids, which is a controlling factor in the number of wells required to inject. Under large-scale implementation of geosequestration, it is likely that throughout the United States, there would be hundreds to thousands of projects and thousands to tens of thousands of injection wells. The technical considerations for injecting CO_2 into geosequestration wells, regardless of volume, will lead to a larger underground project footprint and additional regulatory requirements as compared to Class I or Class II wells. Based on current regulatory draft proposals, the amount of regulatory review for a Class VI project is expected to be more extensive than for either a Class I or Class II project. Therefore, both the initial and long-term costs to regulatory agencies in personnel, equipment, hardware and software, public outreach, and administration are expected to be substantially higher than current UIC program budgets and allocations. This is likely to create a significant barrier to large-scale implementation unless both Congress and state legislative bodies recognize that substantive funding increases are essential.

Environmental concerns

Concerns about the potential impacts of injecting large volumes of CO_2 into the subsurface have been raised by several organizations such as the American Water Works Association, Sierra Club, Environmental Defense Fund, and others. While these concerns do not, *per se*, constitute a barrier, they could delay the orderly development of geosequestration regulation. These concerns include:

- Protection of USDWs
- Prevention of CO_2 leakage back to the atmosphere
- Pressurization of aquifers resulting in changes in the hydraulic gradient of groundwater zones
- The well construction differences between Class II injection for enhanced recovery and those of geosequestration in areas where a conversion from Class II to Class VI status may be sought.

(NOTE: Many organizations, including those noted above, provided comments on the draft UIC rule proposed by EPA in 2008. However, until large-scale geosequestration testing occurs in multiple geologic environments, many questions about the efficacy of environmental protection will remain unanswered. Therefore, overcoming this barrier will require the analysis of projects and research that are not yet completed.)

Ensuring geosequestration regulation is accomplished in a manner that allows efficient program implementation while still providing protection to the environment is a substantial barrier that must be addressed before large-scale geosequestration programs can be implemented successfully.

Property rights issues

In oil and gas extraction, the issue of ownership relates to the fluids contained in the pore space within the rock matrix. However, with respect to geosequestration, it is the pore space, not what is contained in it, that is at issue. Consequently, while the assignment of rights to legally explore for and produce oil and gas (with the exception of coalbed methane resources) has been resolved for more than 100 years, the issue of

pore space ownership may be a key barrier to overcome in the success of large-scale geosequestration. Mineral rights owners, commonly referred to as royalty owners, can legally lease the subsurface to companies to explore for and produce oil and/or gas for which the royalty owner receives a percentage payment for each barrel of oil or million cubic feet of gas produced. (The royalty owner concept is unique to the United States. In other countries, government owns the oil and gas reserves and leases them to companies through a tender process.) U.S. courts have consistently held that mineral rights are superior to surface rights, and it is not uncommon for these rights to be severed from one another so that each right is held by a different owner. Because the question of pore space ownership between surface rights and mineral rights owners is still somewhat unsettled, early geosequestration project applicants may bear the heaviest burden relative to the issue of property rights, as these projects are more likely to result in test cases in the courts. Resolution of pore space ownership must be addressed in order for it to not become a barrier to geosequestration. An analog to pore space usage can be found in the use of Class II injection wells in zones that are used to dispose of salt water from oil and gas production on property where no oil and gas is produced.

Pore space ownership may play a significant role in geosequestration implementation if the state legislative body decrees that some party other than the traditional mineral rights or mineral royalty owner owns the pore space where CO_2 is to be sequestered. The issue central to the concern is that long-term storage (sequestration) of CO_2 without prospect of eventual removal takes the storage reservoir out of play for future exploration of other mineral resources, or as an injection zone for disposal of other wastes. This long-term dedication of a stratigraphic interval requires compensation to whomever the law says is the owner. In at least one state, ownership of the pore space was assigned to the owner of the surface rights (Wyoming Statutes 34-1-152). In some cases, the owner of the surface rights is also the owner of the mineral rights or royalty owner. The long-term dedication of a stratigraphic interval to geosequestration is likely to require compensation to the mineral rights owner. Lacking a well-tested determination or legal precedent, conflict between mineral rights owners and surface rights owners is inevitable where a geosequestration project will take place in a mineral-bearing formation. Wyoming law provides that while the pore space belongs to the surface rights owner, the mineral rights are superior to the surface rights where pore space is concerned (Wyoming Statutes 34-1-152(e)).

Pore space ownership within the boundaries of the project itself is only one element of property ownership relative to geosequestration. Because the underground footprint of CO_2 plumes in a large-scale geosequestration project can extend beyond the boundaries of the project, questions also arise as to what legal framework applies with respect to injection that extends beyond project boundaries. The simplest solution to this issue would be for the sequestering company to obtain appropriate rights to inject within a boundary that contains the full extent of the injected plume. However, this relies on the premise that the full extent of the plume can be determined in advance. Unfortunately, this determination is likely to rely on the application of mathematical models that have yet to be evaluated relative to the migration of large volumes of CO_2 in the subsurface. One concept that has been put forth to resolve this problem is euphemistically called “reverse right of capture.” In oil and gas law, it is firmly established that a well drilled on one property may drain the oil and gas from an adjacent property without compensation to the adjacent property owner. In such cases, the courts have consistently ruled that the remedy for the adjacent property owner is to “go and do likewise.” It has been suggested that this law might be applicable in reverse with respect to injection of CO_2 that crosses property boundaries such that the remedy for an adjacent landowner with respect to injection onto the property is to “go and do likewise” to other adjacent properties. In this regard, modified unitization agreements similar to those used for oil and gas reservoirs

might be applicable to geosequestration. Regardless, the determination of pore space ownership will be a critical factor in the success or failure of large-scale geosequestration.

Financial assurance concerns

Long-term liability, as distinguished from short-term liability, applies to the management of sites for a significant, yet currently unspecified, length of time following the closure of a project as defined by the regulatory agency. Developing systems to guarantee an appropriate level of long-term financial assurance of projects, especially after site closure, will be a key element of successful large-scale geosequestration and will require creative solutions. Some states may assume liability for closed geosequestration sites after a specific period of time, while others may require the operator to retain responsibility in perpetuity. Such divergent approaches lead to questions about the longevity of the regulated entity, the long-term disposition of the regulatory agency, the stability of the issuers of the financial assurance instruments, and the long-term viability of the financial assurance mechanisms to keep up with inflation.

Current state bonding of operations is usually based on general performance criteria or directed toward closure (plugging) of a singular unit such as a well and involves the use of many different forms of financial assurance. In cases where financial assurance involves the use of a liquid asset such as cash or an assignable certificate of deposit, the availability of assurance over long periods of time is not an issue. However, such instruments are static and may not be amenable to updating based on changing circumstances or inflation. While more traditional bonding methods such as surety bonds, letters of credit, or proofs of financial ability are more flexible, they are only as good as the financial foundation of the surety and permittee and therefore may be less desirable for the type of long-term financial assurance needed for geosequestration projects.

Some have suggested that government entities are the only organizations with the longevity needed to manage long-term liability. A barrier to geosequestration may be the unwillingness of state legislators and administrative decision-makers to view long-term liability as a state function, even with the knowledge that, as operators come and go and project transfers occur, exacting compliance may be more costly to the state than establishing a trust fund for post-closure remediation. Although some states, like Texas, established provisions for state acceptance of responsibility for sites following a specific post-closure period, this was limited to specific projects such as Future Gen or the offshore geosequestration repository that the Texas Legislature proposes be owned and run for the benefit of the state by the Texas School Land Board.

Most states, including Texas, Kansas, and Wyoming, have left the responsibility for long-term liability in the hands of the entity that operated the geosequestration project. One solution, not yet codified, is to establish a “risk pool” to which operators of all active geosequestration projects would contribute. Similar to the Oil Pollution Act trust fund, this pool of funds could be used to mitigate problems that might occur following the termination of the post-closure site-management period. Although each state will have to decide on a mechanism for assuring long-term responsibility for geosequestration projects, the specifics will need to rest on a foundation that provides for stable, achievable, affordable, and accessible funding.

Federal reporting requirements

The reporting of digital data is complicated by issues such as compliance with federal data standards under protocols like EPA’s Cross Media Electronic Reporting Rule (CROMERR), which establishes very specific requirements for electronic reporting of data to states or tribes for delegated federal environ-

mental programs.[6] States implementing federal programs such as the UIC program are required to submit an application to EPA describing how their electronic submittal system meets CROMERR requirements. Additionally, new systems must be built to satisfy CROMERR and an application for approval of the system should be submitted at least six months prior to its expected deployment. The rule, however, does not automatically apply to data submitted electronically by a co-regulator such as a state program via the EPA's Exchange Network. Rather it applies based on the original method of submission to the co-regulator. If that submission was electronic, CROMERR applies; if it was not, CROMERR does not apply. Regardless, the application of CROMERR requirements to data submitted electronically by a regulated entity to a delegated program may result in delays in the implementation of geosequestration programs. A workable solution to the issue of state CROMERR compliance will be needed to encourage states to seek Class VI primacy from EPA.

Regulatory capability and capacity

Perhaps the most critical prerequisite of geosequestration programs is the ability of states to recruit, hire, train, and pay for qualified staff to review permits, conduct inspections, manage financial assurance processes, provide legal services, and manage records. While some states will, in all likelihood, initially implement geosequestration programs without adding staff, this will only work as long as the permitting workload is relatively small. If large-scale geosequestration becomes an accepted practice, the expected increase in number of permit applications will eventually necessitate the hiring of qualified geologists, engineers, and technicians, administrators, field inspectors, data managers, attorneys, and support staff.

The issue of staffing for geosequestration regulatory programs is one not only of cost, but also of availability. As the use of geosequestration expands, the number of trained professionals needed to manage the practice will also grow. Demand for qualified personnel is likely to exceed supply. In its document "The 2009 Greenhouse Gas & Climate Change Workforce Needs Assessment Survey Report," the Greenhouse Gas Management Institute reported that almost 45 percent of 719 survey respondents from a wide variety of sectors, including government, expected growth in the greenhouse gas management industry to double in the next five years, while almost 25 percent believed the industry would triple.[7] Growth rates of this magnitude point to a significant potential problem in technical staff availability.

The limited number of professionals with expertise in the disciplines associated with UIC, especially those with the specific expertise relative to geosequestration, will make it difficult for states to compete in an "open market" since government salaries are typically lower than those in the private sector for these types of individuals. As Figure 2 shows, the average salary offers for geologists

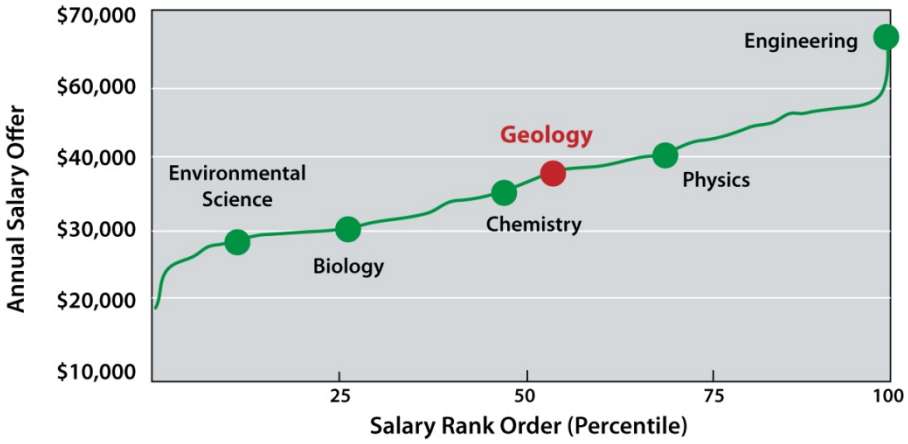


Figure 2: Average Salary Offers for Bachelor's Degree Candidates, Fall 2005
(Data from National Association of Colleges and Employers;
After JGE 2005, v 53, n 5)

with a bachelor's degree is just over $40,000 annually and for petroleum engineers more than $60,000. These salaries may make it difficult for some states to compete with private industry for the services of qualified geologic and engineering professionals. It will be important for states to adjust to this reality by considering their options for attracting qualified personnel.

Federal Regulation of Geosequestration

Three laws—the Clean Air Act, Clean Water Act and amendments, and Safe Drinking Water Act—will play an active role in the any federally regulated Carbon Capture and Storage (CCS) program that encompasses geosequestration.

- **Clean Air Act**. The EPA recently issued a determination classifying CO_2 as a pollutant under the Clean Air Act (CAA) of 1970 and amendments. Using this determination, EPA intends to regulate the amount of CO_2 emissions to the atmosphere. EPA has stated that it does not intend to regulate activities that emit less than 25,000 tons of CO_2 annually. Although states including Texas are challenging the EPA determination in court, EPA is moving forward with the development of regulations under the CAA. The CAA is the linchpin for the implementation of all carbon mitigation strategies, including geosequestration. If EPA's authority to regulate CO_2 under the CAA is not upheld and Congress does not pass CCS legislation, the likelihood of voluntary large-scale geosequestration would be reduced.
- **Clean Water Act**. The Clean Water Act (CWA) of 1977 is the successor to the Federal Water Pollution Control Act of 1972, which was the first major federal law designed to protect water from pollution and led to the formation of the EPA. Since 1977, the law has been amended several times. Through the National Pollutant Discharge Elimination System (NPDES) program, the CWA makes it unlawful to discharge any pollutant from a point source into navigable water without a permit. CWA was passed primarily to control pollution from surface discharges and prior to the inception of the UIC program in 1982, only injection wells associated with NPDES facilities were regulated under the CWA as a separate discharge point on the facility. It is the Phase II NPDES portion of the CWA that is relevant to geosequestration because it controls discharges from construction activities greater than one acre in size. The drilling and development of geosequestration wells and the construction of related surface facilities will likely exceed the one acre limitation and trigger discharge permitting requirements. Unlike traditional oil and gas well sites, geosequestration wells will not be exempt from NPDES provisions. Consequently, NPDES permitting requirements for geosequestration project sites will likely play a role in the development costs of an overall project.
- **Safe Drinking Water Act**, UIC Program. Outside of CAA authority, the Safe Drinking Water Act (SDWA) of 1974 is the most critical federal law governing the geologic sequestration of CO_2. EPA has stated that the drilling and operation of geosequestration wells will be regulated under the SDWA UIC program. The UIC program currently recognizes five classes of injection wells, as defined in Table 1 below.

Table 1: Classes of Injection Wells under the UIC Program

Well Class	Definition	Approximate Number in U.S.
Class I	Wells that inject hazardous and non-hazardous industrial and municipal waste.	523[a]
Class II	Wells used to inject oil and gas exploration and production liquid waste for disposal and enhanced petroleum production purposes.	170,000+[b]
Class III	Wells that inject fluids for the purposes of extracting minerals such as uranium, sulfur, and salt.	19,925[c]
Class IV	Wells that inject hazardous waste into USDWs.	*These wells are banned by EPA except for those used to clean up contaminated USDWs at Superfund sites.*
Class V	Well types that cannot be placed into the other classifications, including geothermal wells, dry wells, aquifer storage and recovery wells, and a host of others. This class of wells was used in West Virginia to regulate a CO_2 geosequestration facility under the EPA's Guidance #83 regarding experimental wells.	750,000–1,500,000[d]

[a] Source: GWPC Class I Inventory of the United States prepared September 2007. Disposing of 9 billion gallons of waste per year.

[b] Disposing of about 864 billion gallons of brine per year based on a 98% reinjection rate for produced water. Volume Source: Clark, C.E., and J.A. Veil, 2009, Produced Water Volumes and Management Practices in the United States, ANL/EVS/R-09/1, prepared by the Environmental Science Division, Argonne National Laboratory for the U.S. Department of Energy, Office of Fossil Energy, National Energy Technology Laboratory, September ANL/EVS/R-09/1.

[c] Source: GWPC Class III Well Inventory prepared by Subsurface Technology, Inc., January 2004.

[d] This number is based on a state-by-state estimate of Class V wells and is expected to increase when an inventory is conducted.

On July 25, 2008, EPA published a proposed rule to regulate the geosequestration of CO_2. This rule, titled "Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO_2) Geologic Sequestration (GS) Well; Proposed Rule,"[8] specified a new class of injection well (designated as Class VI) to address the unique issues related to the long-term underground storage of CO_2. The proposed regulations were developed by an internal EPA workgroup with input from two state members designated by the Interstate Oil and Gas Compact Commission (IOGCC) and two state members selected by the GWPC. The proposed rule contains specifications for geosequestration including:

1. A definition of what constitutes a Class VI well
2. A prohibition against using non-experimental Class V wells for geosequestration
3. The duration, modification, revocation, and reissuance of permits
4. A method for defining the Area of Review (AOR)
5. The corrective action requirements for wells within the AOR of Class VI wells
6. Permit application submission requirements
7. Minimum siting criteria
8. Financial responsibility requirements
9. Well construction requirements
10. A requirement for logging, sampling, and testing prior to injection-well operation

11. Injection well operating requirements
12. The use of annual tests to determine the absence of significant fluid movement into USDWs
13. Demonstrations of external mechanical integrity of well components
14. Testing and monitoring requirements to track the extent of CO_2 plumes and pressure fronts
15. Monthly and semi-annual reporting for changes to the CO_2 stream and injection pressures, flow rates, volumes, and annular pressures
16. Filing of an emergency response plan
17. Injection well plugging requirements
18. Post-closure site care and monitoring requirements
19. A requirement to record the fact that the site has been used to sequester CO_2 and specific information about the injection operation on the property deed.

This list, though not exhaustive, demonstrates the extensiveness of topics covered by the proposed rule, which can be found at http://www.epa.gov/fedrgstr/EPA-WATER/2008/July/Day-25/w16626.htm.

State Regulation of Geosequestration

Each state will determine its own position with respect to the Class VI regulation of geosequestration. Some state governments—such as in Wyoming, Washington, Kansas, and Texas—are moving forward with legal and regulatory frameworks for implementing geosequestration programs. Others are awaiting the outcome of the Class VI federal rule promulgation process and early implementation. Still others believe that geosequestration is unlikely to occur in their state and do not see any value in establishing a geosequestration program.

States moving forward to establish a Class VI geosequestration regulatory program are likely to find that the technical, fiscal, legal, and administrative capabilities necessary for implementation are similar to those for a Class I program. Both types of programs require geologic and engineering expertise related to deep well drilling, construction, operation, monitoring, and closure. However, the depth of knowledge relative to some of these technical areas may differ substantially between a Class VI and a Class I program. For example, the flow modeling required to calculate the movement of CO_2 in the subsurface is somewhat different than that used for fluids that remain in a true liquid phase.

States that will use existing Class II programs to implement the Class VI program are likely to encounter greater challenges, since many of the elements of Class I programs that are similar to those of a Class VI program are not utilized in the Class II program. For example, the Class I hazardous waste program requires a "no migration petition," a complex process involving review of modeling data, hydrogeologic flow regimes, waste/formation interaction characteristics, and many other criteria for long intervals of overlying rock strata; this requirement is absent from Class II programs. As a consequence, some Class II programs may need more up-front staff training to review proposed geosequestration projects than Class I programs.

Regardless of programmatic variations, there will clearly be a need for properly trained geologists, hydrogeologists, geophysicists, reservoir engineers, petroleum engineers, data management specialists, and other technical professionals in a Class VI geosequestration program.

Responsibilities of State Regulatory Programs

State regulatory programs related to natural resource management and protection of the environment often have three primary goals, the direction of which is generally outlined by statutory mandate as to limitations:

- **Protecting human health and the environment**. Protection of human health and/or the environment is the encompassing principle on which all current natural resource conservation and environmental protection regulatory programs are based. The concept of merging sensible natural resource conservation practices with improved environmental protection statutory and regulatory programs has been an evolving process at the state level, mostly during the past 40 years. In the early years of regulation, protection of property rights and exploitation of whatever usable natural resource was being sought took precedence over both resource conservation and protection of the environment. For example, following the drilling of the "Drake well" near Titusville, Pennsylvania, in 1859, it was common to transport wooden barrels of oil by flatboats on Oil Creek (so named for the oil seeps along its banks) to refineries in Pittsburgh. The Paleontological

Research Institution estimates this method of transportation resulted in as much as 50 percent of the oil being lost into the creek due to leaks and barge accidents during shipping.[9] This mode of transporting oil would be unthinkable today, not only because of technological advances but also because we understand the effects of crude oil on humans and ecosystems. However, at the time, it was an acceptable means of transporting oil from place to place. Current regulations place a great deal of emphasis on environmental protection with secondary consideration given to conservation principles.[10] The proposed CO_2 federal Class VI regulations illustrate the sophisticated technologies that are thought to be necessary to protect USDWs and the environment from unwanted migration of CO_2 from injection zones. Requirements for well construction, tanks, pits, pipelines, surface equipment, byproducts handling, chemical storage, and site closure are critical elements of a modern regulatory program. Coupling these requirements with sophisticated technologies such as geophysical logging, flow modeling, and remote sensing will ensure that underground injection of CO_2 does not threaten or endanger USDWs and, by extension, human health.

- **Conserving natural resources.** In the development of early model oil and gas statutes and regulations in the 1930s, environmental regulations were secondary to the concern over both physical and economic waste of primarily oil and eventually gas. Production acceleration had caused supply to exceed demand, necessitating stern conservation practices. Additionally, concerns over each royalty owner receiving a "fair share" of the resource underlying his land brought about the principles of correlative rights. Most model statutes recognized the protection of water as a secondary goal. Most state regulatory programs for oil and gas exploration and production have provisions to require property owners to join together, or pool their rights, to avoid the stranding of oil and gas resources.
- **Protecting correlative property rights.** Some state oil and gas regulatory programs are also responsible for ensuring the protection of correlative property rights. For example, many state oil and gas regulatory programs use a well spacing and minimum acreage requirement to avoid one property owner's right to drill and produce oil or natural gas from encroaching on an adjacent property owner's right to do the same. Since the geographic footprint (Area of Review, or AOR) of CO_2 geosequestration projects could encompass hundreds to thousands of acres, as shown in Figure 3, the protection of correlative property rights could play a significant role in their development. As CO_2 plumes cross property boundaries, resolution of surface versus mineral rights, private versus public property rights, and local zoning laws and interstate property disputes may become critical to the successful implementation of large-scale geosequestration. Such issues as correlative rights and legal ownership of the injection zone pore space (royalty or surface owner) are important issues for states to resolve to their own satisfaction. However, they are not part of the Class VI regulatory scheme proposed by EPA, nor do they appear to be an EPA primacy issue.

Figure 3: Comparisons of potential AORs; Class I vs. Class VI
(After USEPA, 2009)

Overall, the multi-level responsibilities assigned to state regulatory programs provide the basis for one of the greatest strengths of such programs. At the federal level, the regulation of geosequestration is strictly limited to a specific goal. For example, the only goal of EPA is the protection of human health and the environment. In state programs, however, provisions for the protection of property rights and the drive to conserve natural resources play a complimentary role in the development of a regulatory program. Further, the authority assigned to state regulatory programs to deal with these issues results in a more flexible approach to regulating geosequestration than that currently available in a federal regulatory scheme.

Program Development Process

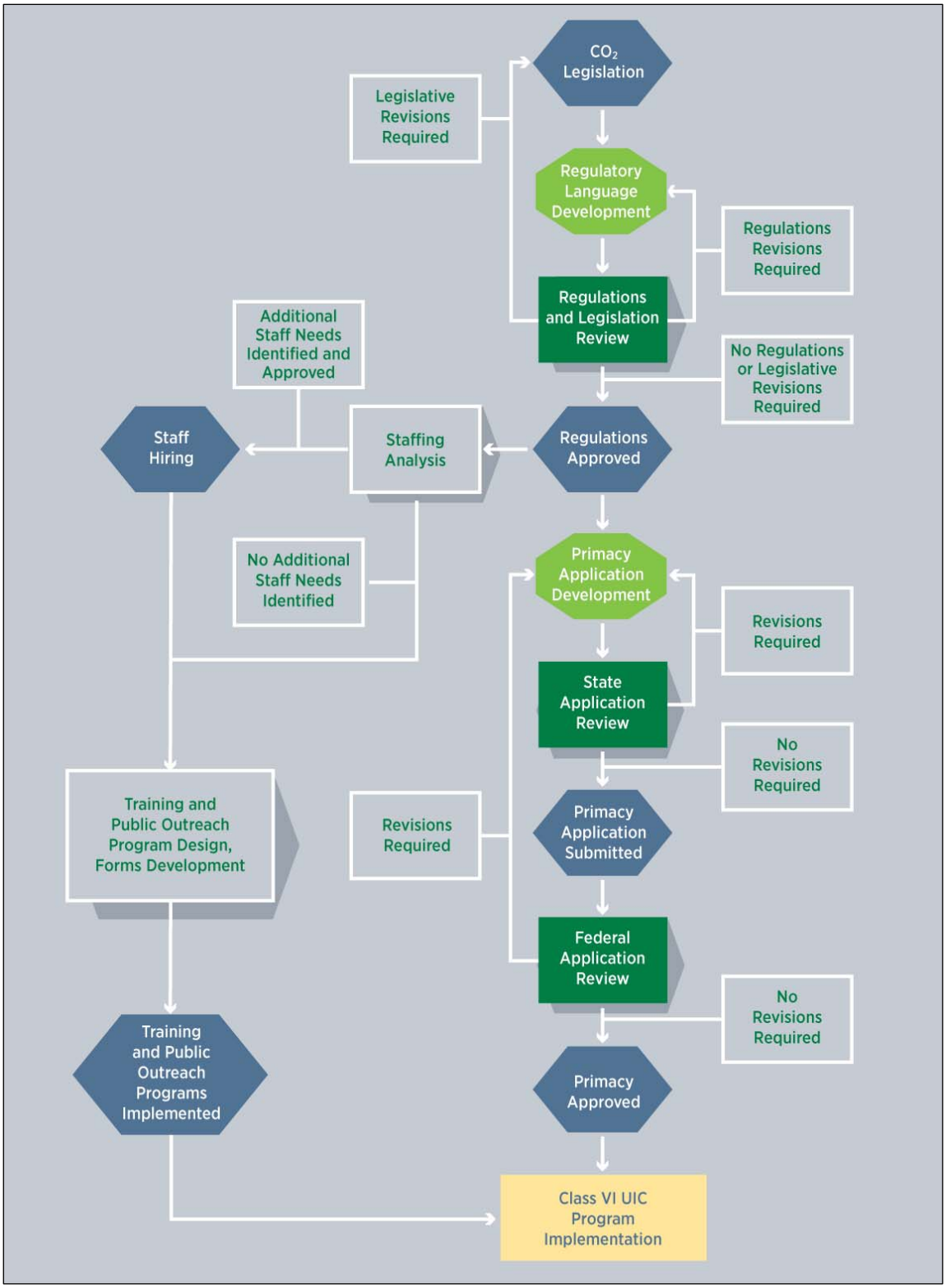
While development of a regulatory program is not as simple as passing laws and enacting regulations to implement those laws, it need not be a complex or confusing process. In general, developing a regulatory program for geosequestration should follow a path that includes:

- Developing statutory authority (legislature)
- Developing regulations (regulatory agency)
- Reviewing and revising regulations (regulatory agency with public input)
- Approval of the regulations (legislative, board or commission)
- Development of a primacy application or revision package (regulatory agency)
- Approval of primacy (EPA)
- Evaluation of staffing and funding, training, and public outreach needs (regulatory agency)
- Development of training and public outreach programs, process controls, procedures, and forms (regulatory agency)
- Hiring and training of staff (regulatory agency)

Implementation of a geosequestration regulatory program will require the diligent efforts of several governmental entities and other stakeholders such as the regulated community and the general public. Ensuring participation in the process by all stakeholders will be a critical factor in the regulatory development process. Although the regulatory agency has the responsibility for much of the program development process, other entities have some measure of control or responsibility. For example, enactment of statutes requires state legislative action, and approval of a regulation often requires action by a governing board, commission, or in some cases a state legislature. Further, although regulations are usually developed by the regulatory agency, a public notification and comment process is typically required before a regulation can be approved. The successful conclusion of any regulatory development process for a geosequestration program will, therefore, be dependent on factors such as the level of public concern about geosequestration, the number and length of public comment periods, the meeting schedules and statutory enactment processes of state legislatures, the meeting schedules and approval processes of boards or commissions, and the limitations inherent to the EPA primacy approval process.

A simplified diagram of the regulatory program development process is shown in Figure 4.

Figure 4: Flow Diagram of Regulatory Development Process



Identifying State Regulatory Needs

The following sections of this report summarize the areas of needs likely to be encountered by states electing to establish UIC regulatory geosequestration programs. Included are discussions of the current status of geosequestration-related efforts in the six study states.

Eight categories of needs were identified through the GWPC assessment:

- Class VI primacy enforcement delegation
- Legislative authority
- Regulatory language
- Regulatory program design and interagency coordination
- Funding and staffing
- Data management
- Public outreach
- Training.

Table 2 is a summary of regulatory needs by study state based on the analysis for each program element shown above. An **N** in a box indicates a need that has not been addressed, a **Y** indicates a need that has been or is being addressed, and an **X** indicates a need that may require additional attention.

Table 2: Summary of Regulatory Needs

State	Class VI primacy	Legislation	Regulations	Program design	Funding and staffing	Data management	Public outreach	Training
Kansas	N	Y	Y	N	X	N	N	N
Michigan	N	N	N	N	N	N	N	N
Mississippi	N	N	N	N	N	N	N	N
Texas	N	Y	Y	N	X	N	N	X
West Virginia	N	Y	Y	N	N	N	N	N
Wyoming	N	Y	Y	N	N	N	N	N

(NOTE: Some DOE, NETL Regional Partnerships are in the process of developing technical training programs but these are not specifically directed at regulatory personnel.)

As Table 2 shows, five elements appear to have the greatest need relative to establishment of state geosequestration programs:

1. Class VI primacy
2. Funding and staffing
3. Data management
4. Training (technical and programmatic)
5. Public outreach.

Class VI Primary Enforcement Delegation

Background

Since the inception of the federal UIC program in 1980 under SDWA, EPA has encouraged states to administer and enforce regulatory program elements under a process referred to as primary enforcement delegation (primacy). Congress, in fact, intended for states, not EPA, to implement the UIC program. States may apply to EPA to manage the federal program at the state level and EPA delegates its authority through a State/EPA Agreement (SEA). Originally, Section 1422 of SDWA was the only statutory vehicle for seeking primacy, and this option is still the only one available for most classes of UIC wells. However, in 1980, Congress passed Section 1425 to the SDWA, which allowed states to seek primacy for oil- and gas-related injection wells. These wells, referred to as Class II UIC wells, include injection wells receiving produced waters from oil and gas extraction operations and cover injectate destined for either terminal disposal or for the enhanced recovery of oil. The Section 1425 procedure allowed a state having an existing Class II UIC program to apply for primacy using an "equal effectiveness" standard. This gave a state the opportunity to demonstrate that existing statutory authority and promulgated regulations were equally effective at protecting USDWs as would be the implementation of the federal UIC regulations promulgated under Section 1422. The Section 1425 program has degrees of flexibility to deal with both technical and administrative situations not afforded programs implemented under Section 1422. Twenty-three oil and gas states administer Class II primacy programs under Section 1425, twenty administer Class II primacy under Section 1422 and fifteen have acquired Section 1422 primacy for Classes I–V, excluding Class II. UIC programs for all classes of wells in non-primacy states are administrated by EPA under Section 1422 Direct Implementation (DI).

EPA stated that regulation of CO_2 geosequestration wells be administered through the UIC program under a newly created class of injection wells referred to as Class VI. EPA has also indicated that states seeking primacy delegation will be subject to the Section 1422 requirements. The Section 1425 process will not be available. Section 1422 requires that all regulations promulgated by primacy states must be as stringent as those implemented by EPA. States may pass more stringent regulations than EPA's to address special geologically sensitive situations that are intrinsic to their state. Historically, states applying for primacy for Classes I, III, IV, and V found the most expedient solution was to comply with the federal regulations and adopt them by reference. This option ruled out the semantic discussions that could occur over the complexities of rule language and whether the original intent of the federal regulations has been preserved. However, during the interview process, all six study states indicated they would promulgate their own state rules without adopting the federal rule by reference. This is a significant departure from past practice and will result in a more time-consuming review of any primacy application submitted by one of the project states.

On December 10, 2010 EPA published its final rule regarding the Class VI program in the Federal Register. In the rule, EPA stated that primacy for the Class VI program could be granted to the states separately from other Section 1422 well classes. As a result, states without a Section 1422 program will be able to apply for primacy of the Class VI program without acquiring primacy for Class I, III and V wells. This was an important decision which should facilitate primacy for states that do not currently have primacy but want to run a Class VI program without taking responsibility for other well classes. The EPA rule also said that states with an existing Section 1422 program could continue to issue permits for

geosequestration wells under their current Class I program until such time as they acquire the Class VI program. This allowance did not extend to states without a Section 1422 program. However, states are required by the rule to apply for Class VI primacy within 270 days of the date the rule was approved and upon receiving primacy those permits issued under the Class I program would have to be re-issued as Class VI permits within 365 days of the date primacy was granted. Consequently, states will need to assure that Class I permits issued for geosequestration purposes meet all of the requirements for the issuance of a Class VI permit as specified in the federal rule. If a state fails to apply for primacy within 270 days, EPA would implement the Class VI program in that state. In this case, any state permits issued for Class I wells used for geosequestration would be subject to re-permitting by an EPA regional office. The full text of the EPA rule can be found at http://www.gpo.gov/fdsys/pkg/FR-2010-12-10/pdf/2010-29954.pdf

State Needs

None of the six study states indicated they had started to develop the program description for a Class VI program, which would be required as part of a primacy application to EPA. States such as Kansas, Texas, and Wyoming, where sequestration laws have been passed and regulations have been or are in the process of being promulgated, should begin working on a Class VI program description based on the recently approved federal rule. Further, these states will need to compare the state and federal rules to assure the state rule meets the Section 1422 stringency standard. As part of any primacy package, EPA also requires a letter from the governor stating willingness to take primacy and a letter from the state attorney general certifying that regulations are in place and are constitutional. All six study states indicated the development of a model Section 1422 primacy application for the Class VI program would be beneficial to them as each state could pattern its application on the model and reduce the amount of time doing program description revisions to address shortcomings identified by EPA reviewers. Kansas is an example of a state where one agency, the Department of Health and Environment (KDHE), has Section 1422 primacy while a second, the Kansas Corporation Commission (KCC), has primacy for Section 1425 Class II wells except Class 2-H. The Kansas Legislature gave the authority to KCC to regulate geosequestration wells. EPA currently works with both agencies relative to the wells regulated under their respective primacy agreements. Texas also has two agencies involved in geosequestration. In the past, each agency has unilaterally submitted amended program descriptions to EPA when program changes occurred. Whether this is a unique situation or not, guidance is needed to allow the state to take the most efficient option related to assignment of a lead agency for filing a primacy application.

Legislative Authority

Background

State legislation will provide the authority for the promulgation of regulations, assignment of jurisdiction to state agencies, establishment of mechanisms for funding, and direction to seek primacy for CO_2 geosequestration programs. Without specific legislative direction, state agencies are limited to regulating geosequestration within their existing authority. In most cases, this would limit a state agency's jurisdiction to a currently implemented program. In the case of CO_2 geosequestration, this is expected to most often be the Class I, III, or V UIC program. The same is true for any state with a Section 1422 program governing Class I, III, and V wells. Therefore, the issue of continuing authority to regulate geosequestration under existing UIC primacy programs could be problematic once EPA makes a primacy delegation framework decision.

In some cases, state laws establish specific requirements that limit the scope of the regulation. For example, a state law is likely to provide a regulatory agency with the authority to establish monitoring, measuring, and verification requirements and allow agency personnel the right of ingress and egress to make unannounced inspection; but such legislation, *per se*, is unlikely to specify the requirements for these activities. A state law may specifically establish the provisions for liability assignment or bonding requirements without providing particulars on assurance coverage. Laws may also authorize establishment of dedicated funding with only general guidance using phrases such as "fees to cover permitting, inspecting and monitoring, but not remediation…" A recent example of this is the law passed by the state of Kansas regarding the long-term liability requirements for geosequestration, whereby the state legislature identified the operators as permanently responsible parties with respect to post-site-closure liability on geosequestration projects.

State Needs

Kansas, Texas, West Virginia, and Wyoming have, over the past three years, enacted laws authorizing the promulgation of regulations for CO_2 storage or geosequestration prior to and independent of the development of EPA's Class VI UIC regulations. Washington, though not a study state, has also passed legislation and promulgated regulations. The action in the four study states noted above was taken in response to increasing concerns over the lack of control over potential proliferation of Carbon Capture and Storage (CC&S) facilities and recognition that this activity had both economic and environmental ramifications. In all cases, the legislatures mandated the responsibility to an agency or agencies based on each states particular needs and agency capabilities.

Four of the six study states (Kansas, Texas, West Virginia, and Wyoming) have enacted laws that provide legal authority to state agencies to manage a geosequestration program. Two of the six study states (Texas and West Virginia) have been directed by legislation to acquire primacy for the Class VI program. Only

one of the study states (Wyoming) has addressed the issue of pore space ownership by designating that the owner of surface rights owns the pore space. Wyoming law also specified that mineral rights are superior to pore space rights with respect to geosequestration. These actions by Wyoming could forestall the inevitable legal challenges to pore space ownership that may occur in other states. Wyoming has designated a single state agency, the Wyoming Department of Environmental Quality (WYDEQ), as the regulatory entity charged with geosequestration regulation. Conversely, Texas has designated two state agencies (TRRC and TCEQ) as having jurisdiction based on the purpose and geologic setting of the geosequestration injection zone. Kansas has designated the Kansas Corporation Commission (KCC), which administers the Class II UIC program, as the agency to regulate geosequestration. Two states (Michigan and Mississippi) will need enabling legislation before they can begin the process of developing regulations and seeking primacy. Kansas and Texas appear to be the only study states that have enacted legislation setting out the mechanics of a funding mechanism for implementation of a geosequestration program. Kansas also has set out the levels of funding and has a regulation that establishes a schedule of fees to fund program administration and implementation and a separate fee of three cents/ton of injected CO_2 that goes to a post-closure remediation fund.

Regulatory Language

Background

Once statutory authority has been provided through legislation, the state must develop regulations to approve and oversee geosequestration project development. State primacy programs must adopt state regulations that are as least as stringent as those adopted by EPA. There is no opportunity for a demonstration of equal effectiveness of an existing CO_2 regulatory program such as currently exists for Class II UIC programs under Section 1425 of SDWA. Kansas, or any other state where state regulations have gone into effect before EPA's Class VI version does, may have to amend some regulatory requirements to conform to the federal stringency with limited opportunity for deviation. The EPA Class VI program would not affect future state policy matters on ownership of pore space or specific responsibility for long-term care.

The regulatory language proposed by EPA for Class VI appears to differ significantly in technical information needs from existing Class I, II, and V UIC programs. These factors will result in the need for states to develop regulatory language that is substantially different from the language of existing Class I, II, III, and V UIC primacy programs. Two major differences in the program elements are:

- Regulatory language designed to implement the Class VI program may include elements that are not currently part of other UIC programs, such as plume modeling, geophysical monitoring, soil and air monitoring, special materials and construction requirements, pre-project water sampling, seismic site assessment, post-site-closure care, monitoring, and financial assurance. Injection only below the deepest USDW is currently a requirement for Class I; however, the Class VI regulations may or may not prescribe a minimum intervening interval between USDWs and zone(s) of injection.
- The depth of investigation to which many elements of the program (e.g., AOR determination, mechanical integrity testing, site characterization, and well plugging) must be subjected is, in some cases, greater than even the Class I hazardous waste UIC program.

Regulatory language is typically much more specific and expansive than legislation because it is the nuts-and-bolts description of the process for regulating the activity. For example, the legislation may specify that an agency promulgate regulations to govern the underground injection of CO_2 in a manner that protects human health and the environment, while the regulations promulgated to comply with the legislative directive could contain specifications for the permitting, financial assurance, drilling and completion, testing, operation, monitoring, and closure requirements for geosequestration wells or projects. State regulations may also address fees to fund all or part of the program when they are not specified by statute. Some states have regulations authorizing the assessment of penalties and fines for non-compliance. Each state promulgates rules using its own particular state process and approved regulatory format and rule codification. These processes are often similar in nature because each state has an administrative procedure act that generally conforms in content to those in other states.

Two basic approaches govern development of regulatory language: prescriptive and performance-based.

- **Prescriptive regulation.** Prescriptive regulation relies on particular requirements, specifications, methods, and criteria to achieve compliance, and usually provide a blueprint for management of an activity. A prescriptive regulation may require someone to perform a specific test on a piece of

equipment using an established series of steps with a particular measure of success that is often defined numerically. Prescriptive regulations provide regulatory certainty and can be easier to implement because everyone has a clear understanding of what is required. At the same time, prescriptive regulations are inflexible and may not work under all circumstances.

- **Performance-based regulation.** Under performance-based regulation, the outcome to be achieved is specified but the methods for achieving it are left to the regulated entity and are geared toward obtaining a particular result. A performance-based regulation may specify the measure of success or compliance but leave the selection of the specific test to achieve success to the discretion of the regulated entity. Under a performance-based regulation, a state may specify that well cement used to prevent the movement of fluids in the annular space behind casing must be approved by the regulatory agency; a regulated entity could propose a cement mixture and/or cementing program to the regulatory agency and, upon approval, cement the well in the described manner. The regulatory agency may have a wide range of accepted practices and materials that the operator may select from with the goal being the securing of the well. Performance-based regulations provide flexibility and engender creative thinking to address special conditions. However, because they are more flexible and lead to new technological approaches, it is sometimes difficult to ensure that everyone has the same understanding of the requirements needed to successfully implement the regulation.

Both regulatory schemes have their positive and negative aspects. State regulations often contain a mixture of prescriptive and performance-based language, as does the proposed regulatory language in the latest federal Class VI draft. For example, 40 CFR Part 146.81(d) Definitions, "*Post-injection site care* means appropriate monitoring and other actions (including corrective action) needed following cessation of injection to assure that USDWs are not endangered as required under Part 146.93." This is a clear example of a performance-based standard since it does not specify the requirements for meeting the standard but does establish the outcome that must be achieved. Conversely, 40 CFR Part 146.84(a) Area of Review states that, "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." This language is prescriptive, specifying "computational modeling" as the only acceptable method for delineating the Area of Review for a Class VI well.

The steps in regulation promulgation generally include:

1. Development of a draft rule
2. A public comment period and/public hearings
3. Responses to comments and incorporation of some into redrafted rules
4. Approval of final draft by the attorney general for constitutionality and by an administrative agency for conformance with state-approved format
5. Approval of a final rule by a governing body such as a commission, board, or council
6. Approval by a governor and/or legislature and publication of the rule in a state register through an office such as a secretary of state or state revisor of statutes.

State Needs

A comprehensive comparison of each study state's proposed or approved regulatory language with that of the proposed federal Class VI regulations was not conducted as part of this study since only one state (Kansas) has regulations and three others (Texas, West Virginia, and Wyoming) are currently drafting or promulgating regulations. As previously stated, the regulations proposed by each state will need to be adjudged as stringent as EPA's Class VI final version to achieve primacy delegation under Section 1422 of the SDWA. This will require a comprehensive comparison of each state's regulation against the final EPA UIC Class VI regulation to determine whether or not the state regulations meet the stringency standard. In one state (Texas), the development of parallel regulatory language by two separate agencies is unique and needs further study to determine how such duality will affect both the primacy process and the application of the regulations. Texas has in the past used Memoranda of Agreement (MOAs) to delineate regulatory responsibility and such an instrument would be beneficial to smoothing differences in two regulatory drafts. However, since the Class VI program will involve a Section 1422 delegation of authority, each state will need to conduct such a review before submitting an application for a new or revised Class VI primacy program. Those states that have never had primacy for an UIC program may need a model set of regulations to use in drafting an acceptable version to submit with their primacy package.

Regulatory Program Design and Interagency Coordination

Background

Regulatory programs are assigned to state agencies by legislative mandate and the responsibility may be given to one agency, as in Kansas (KCC), or to more than one agency, as in Texas (TRRC and TCEQ). This report does not intend to suggest that responsibility for CO_2 geosequestration regulation is better housed in a state agency with one type of statutory mission over another (e.g., water, environment, energy). If perceived statutory or regulatory deficiencies are identified by either the state or EPA during the pursuit of primacy for UIC Class VI, it is up to the state administrative and legislative process to effect changes to gain acceptance.

A state program may be implemented at a division or bureau level within an agency or it may be attached to an existing program such as water or UIC within a lower-level administrative unit. The source of funding for the program, while not usually a determinant for organizational assignment, may give the financial accounting of activities separate budgetary status, particularly if the fund is solely dedicated to the program. In some states, responsibility for the UIC program is divided between a resource conservation agency and an environmental protection agency, and so is the federal funding. Memoranda of Understanding (MOUs) are often drafted between or among agencies with shared program responsibility to delineate which entity does well plugging, UIC inspection, permitting, or enforcement activities. In other states, the entire UIC program functions under the EPA. Within the program itself, divisions of responsibility often result in a wide variety of implementation systems. This diversity of program schemes may lead to substantial issues during the early years of implementation of geosequestration regulations as jurisdictional boundaries, inspection responsibilities, and differing agency personalities gradually accommodate a new program requiring a different method of operation.

It will be important for states with multi-agency jurisdiction to develop interagency agreements to assure the efficient and effective management of geosequestration regulation. This may involve the development of both formal and informal interagency agreements. In some cases, development of interstate agreements or inter-jurisdictional agreements between state and federal and state and tribal programs may be required. Negotiating and implementing these agreements will facilitate geosequestration program implementation. As a part of a multi-agency effort, a road map showing the division of responsibility afforded each agency should be developed to assist each agency with program implementation and coordination. As a part of a multi-agency effort, the road map showing the division of responsibility afforded each agency should be highlighted as a part of the outreach program.

State Needs

The development of programs to regulate geosequestration will, in most cases, become an extension of existing UIC programs. States are unlikely to establish new agencies or divisions to implement regulations. While most programs may require some modifications to address the highly technical and complex issues related to geosequestration, there is no reason to believe that managing a geosequestration program will require wholesale changes in the internal organization of state UIC primacy programs unless geosequestration becomes, in itself, a major program effort. Even in Texas, where the jurisdiction for

geosequestration will be split, the two agencies involved (TRRC and TCEQ) have a long history of interagency coordination that should not result in substantial changes to programmatic structure or internal administrative program reorganization. However, there are two areas that may require new or substantially upgraded programmatic elements:

1. **Monitoring, measuring, and verification (MMV).** This function is related to the environmental aspects of the geosequestration program. MMV in existing UIC programs, where it is performed at all, is minimal and would need significant upgrading to address the complexities of CO_2 plume tracking, including geophysical monitoring, ground water sampling and analysis, soil and air sampling and analysis, and a host of other possible MMV techniques.
2. **Long-term liability.** Current mechanisms for managing liability are based on relatively simple bonding programs that utilize surety, cash, CD, and other types of performance or penal bonds to ensure compliance. These instruments were designed for the array of enforcement tools typically implemented for existing UIC well classes. For example, in the Class II program, bonds are usually released upon plugging of a well where the operational life was between 10 and 20 years. Release of a site upon which the well was located is a relatively new concept for Class II facilities. In the case of geosequestration, the bonding period may have to extend well beyond the operational life of a site and could result in maintenance of an instrument for periods in excess of 50 years after a well is plugged or a project site is closed. Consequently, new forms of financial assurance with extended life cycles may need to be considered for the Class VI program. Additionally, some states may assume long-term liability for geosequestration sites. This would necessitate the implementation of new processes, such as dedicated remediation funds, not currently used by most states. If long-term liability is to remain with the operator forever, as years pass and companies dissolve, the bonding responsibility may have to be transferred legally through a very well-defined procedure.

Three of the study states (Kansas, Texas, and Wyoming) are currently developing some of the programmatic elements for a state geosequestration program, such as establishment of guidelines, manuals, organizational systems, data management capacity, and financial assurance mechanisms.

Funding and Staffing

Background

In the past, EPA has requested that agencies seeking primacy delegation for one of its programs estimate the number of staff needed to effectively administer the program. While EPA has on occasion provided states with its own estimates of the required staff, including numerical breakdowns by discipline (e.g., geologists, engineers, clerical), EPA's numbers historically have been found to be overestimated once state implementation of the program has begun. Regardless, projecting staff needs for a program in its regulatory infancy is quite difficult and often hard to sell to legislators who allocate state funds and cast a jaundiced eye toward anything that could be viewed as an unfunded mandate.

Another consideration in developing staffing projections is that very often the first few years of a new program are more staff-intensive at the program administration level, while, as the program matures, staffing needs shift toward the field inspection and enforcement arena. One major difficulty experienced in administering state primacy UIC programs over time has been EPA's desire to have additional reporting of program results incorporated into State EPA Agreements (SEAs) that weren't required in the earlier years of the program. Any time a program "bar is raised," even if it does not include implementation or promulgation of additional regulations, additional staff and/or funding is required.

Regulatory oversight of a cluster of Class I wells at an industrial location is usually not as staff- or time-intensive as the review and approval of applications in a virgin area with little or no existing geologic or cultural information, irrespective of the injection volume or rate. However, for purposes of estimating staffing and funding needs, wells in the Class I program most closely approximate the level of regulatory management needed for a Class VI program. The 523 Class I wells in the U.S. inject about 21.8 million tons of waste each year. In 2006, power plants produced about 2.8 billion metric tons of CO_2.[11] This means power plants produce nearly 100 times the amount of all waste injected into Class I wells annually. For relative comparison purposes only, if a linear relationship between volumes of injection and numbers of wells were carried over from the Class I to the Class VI program for power plant CO_2 alone, about 52,300 Class VI wells would be required to inject the amount of CO_2 generated each year. Many other sources of CO_2 such as biofuels production, cement production, and refining substantially increase the total volumes of CO_2 that may need to be injected. Clearly, this level of geosequestration would result in a significant increase in workload on regulatory agencies with a corresponding need for additional staff. The statistical comparisons between Classes I and VI may or may not be completely valid, but they are the best available guideline at this time.

State agencies regulating geosequestration are typically composed of staff with expertise in UIC technology. Although none of the study states has conducted a full-scale evaluation of staffing and funding needs, each was asked to provide estimates of additional staffing needs for a geosequestration program based on the following criteria:

- **Criterion 1.** Number of FTEs by type needed to sustain an annual permitting workload of 10 geosequestration permits.
- **Criterion 2.** Given the need for ongoing monitoring, reporting, AOR re-review, permit modifications, etc., for the 10 wells/projects permitted in each previous year, the number of FTEs, by type, needed to sustain this annual workload for a period of 10 years, equaling 100 permitted

and operating wells/projects.

- **Criterion 3.** Anticipating a post-closure site-care period of between 10 and 50 years, the number of FTEs, by type, for post-closure management.

The estimates in Table 3 are extrapolated from responses to the state questionnaires and follow-up interviews conducted as part of this study. State agencies tended to answer the questions posed in the study in somewhat different ways, making data comparison between states difficult. Nevertheless, GWPC believes this estimate provides a good preliminary assessment of the fiscal needs of state agencies and EPA regions for the implementation of CO_2 geosequestration. The estimate of staffing and fiscal needs assumes a phased implementation of CO_2 geosequestration under the UIC program with increasing numbers of wells over time. The FTE costs represent the annual cost per unit (state primacy or EPA regional program). However, the total annual cost assumes geosequestration will be implemented in all 50 states. For implementation in fewer than 50 states, the figures must be reduced by an amount commensurate with the impact of the particular state removed from the estimate. The amount of reduction in costs resulting from a non-participating state can only be determined on a case-by-case basis and was not evaluated for this study.

Table 3: Estimated FTEs and Costs Using Class I and Class II UIC Program Scenarios

Annual number of wells per state	Approx. number of additional FTEs needed per state	Annual cost per state	Total annual cost of program in 50 states (in millions of dollars)
10	1.0–1.5	$100,000–$150,000*	$5–$7.5
25	2.5–3.75	$250,000–$375,000	$12.5–$18.75
50	5.0–7.5	$500,000–$750,000	$25–$37.5
100	10–15	$1 million–$1.5 million	$50–$75
Total ranges	1.5–15	$100,000–1.5 million	$5–$75

* Annual costs were estimated at an average of $100,000 per FTE to be consistent with responses reported in a 2009 survey of staffing and funding needs conducted by Argonne National Laboratory (ANL) on behalf of the GWPC.[12] Responses to the survey were received from 16 states and 5 EPA regions. Each agency was asked if it had adequate existing staff and resources to evaluate the following numbers of new CO_2 applications per year: 1, 5, 10, 25, 50, and 100. Most agencies felt they could handle one to five new applications per year. Several states said they could handle at least 100 new EOR wells. Some said they could handle no additional workload. Many states indicated that they could use one or two new permit writers and one to four more field inspectors. The estimated costs for one new FTE ranged from $50,000 to $120,000. The agencies were asked to rank their needs by category. In order of importance, these needs were identified as application review, permit writing, site inspections, reviewing monitoring data and reports, compliance and enforcement, equipment, public hearings, and training.

State Needs

The annual personnel costs for a national Class VI UIC program are estimated by GWPC to be between $5 million and $75 million. The actual costs would depend on the number of wells permitted and the development of public outreach and training programs. Currently, UIC receives annual federal funding in the amount of approximately $10.5 million for all federal and state programs. This means that annual

federal funding for the combined Class I, II, III, and V programs is less than the amount needed for all but the lowest estimated implementation cost of a Class VI program alone by current UIC primacy and DI programs.

To date, none of the study states has undertaken a comprehensive evaluation of fiscal and personnel needs for implementing a UIC geosequestration regulatory program. While some states such as Kansas and Texas are taking steps to address state funding needs for their proposed Class VI programs, the amount of funding provided by these efforts are not yet known. Consequently, it is very likely a substantial increase in federal funding for the UIC program or a separate allocation of fund for Class VI will be needed to implement the Class VI portion of the program. Several of the states interviewed said they planned to use current staff levels for initial Class VI program implementation. However, this approach is likely to become untenable under even moderate levels of Class VI permitting activity and should be considered more of a managerial position rather than a long-term strategy for addressing program staffing needs.

Data Management

Background

Proper regulation of a CO_2 geosequestration project requires that data be collected to determine if the permit conditions are being followed and if the permit satisfactorily regulates geosequestration for storage and environmental protection. Current data management systems will need to be upgraded to manage the complex data sets and large data volume necessary to effectively implement geosequestration programs.

Sequestering carbon from fossil fuel-powered plants, biofuels operations, cement manufacturing, and many other sources for permanent below-ground storage is a new approach to managing global climate change. As with other UIC well classes, the potential risk to USDWs must be assessed and monitored. Specifically, regulators must be able to assess the variables of geology, current use of the formation, and stoichiometric calculations derived from computer models of the *in-situ* water quality to predict chemical interactions that may pose risks to USDWs. The success of the technology also depends on the makeup of the receiving formation. The geochemistry, porosity, and permeability of the receiving formation must be evaluated to determine if CO_2 will change the chemistry in the formation and any trace elements that may be mobilized. The geology of the receiving formation also must be understood to determine the vertical and horizontal migration potential of the CO_2 plume. All of these elements must be entered and updated in a data management system.

An ideal geosequestration data management system should have the ability to store data specific to geosequestration, import data from various state, local, and federal databases, contain a GIS interface, and have report-writing capabilities.

Features of an ideal geosequestration data management system include:

- **Data warehouse.** This feature provides data specific to the geosequestration operation, as well as the ability to import data from other applications.
- **User interface.** The user interface includes key word, full-text, and advanced Find features. In addition, there should be a data view paired with a GIS window so that the user's focus is always on using information as opposed to searching for it. The search capability minimizes the need for general users to compose queries.
- **Field inspection utility.** Onsite inspection is the most expensive component of any regulatory oversight program and the one that agencies can least afford to compromise to meet the mission-critical goal of water resource protection. Further complicating the technical requirements for data collection is the fact that such inspection programs are often run by people of widely varying computer skills. The people who run these programs include managers who need summary information on demand, technical and laboratory staff who require sophisticated analysis tools, and field inspectors.

- **Monitoring data.** Data storage and management needs include water quality, laboratory information management, produced water management, and water quantity assessment. The application will be used to manage surface water, ground water, and waste stream quality.
- **Electronic permitting.** Allows industry operators to submit regulatory forms over the Internet, thereby eliminating paper forms that must be mailed to the various state offices and manually re-keyed. These electronic submissions help reduce processing time and allow for improved data to be available to the staff members who are making regulatory decisions.
- **Electronic reporting.** Data transactions that involve manual data entry and error checking are expensive for both industry and regulating agencies, and the cost can be measured in terms of the associated delays in critical decisions affecting other aspects of geosequestration operation and development processes. Electronic reporting should be an Internet-based solution for regulatory reporting. Electronic reporting eliminates rework loops for both the operator and the agency stemming from incomplete or incorrectly formatted submittals. Electronic reporting applications have built-in multi-level data validations, so formatting and other errors are flagged as operators complete the forms. The application also checks to make sure that required fields are filled in and that valid codes are used. This streamlined reporting process thus reduces the cost and time for regulatory compliance and helps states capture revenues due from oil and gas activity.
- **Modeling.** Any large-scale CCS project proposal will have a time and transport model as part of the permit process. Permitting agencies will need the capability to evaluate the model and/or conduct their own modeling exercise based on the permit conditions and known geology and to store the results of modeling.
- **Online data access.** Online data access should be available with an application designed to speed data delivery through a single interface that combines keyword full-text indexed searches with spatial analysis and a hyperlinked detail data grid display. The result allows users to take virtual tours of the data via a Web browser.

State Needs

While most states have electronic data management systems capable of storing vast quantities of information, no state has a comprehensive system in place to gather, store, track, and report data for a large-scale UIC geosequestration effort. It will be necessary to develop a schema for integrating geosequestration data into existing state databases or implement new databases for this purpose. Additionally, data systems such as GIS and electronic capture of paper records will be needed to implement specific elements of geosequestration related to mapping, reporting, and records access.

Access to electronic data will be a major need for state agencies. Public awareness of geosequestration project proposals in their planning stages and during the initial parts of an application review process is essential to their acceptance. To facilitate this awareness, data management systems are necessary to provide real-time information to the public on the intent of decision-makers so that comments on projects can be based on factual knowledge concerning a proposed project. Access to electronic data will also be needed by field personnel to allow efficient inspection and observation of project activities and outcomes.

Public Outreach

Background

The advent of the Internet, social networks, and e-mail has created unprecedented opportunities for information exchange and for interacting with others on shared issues and concerns. Electronic communications have also resulted in an increasing desire by the public to participate in the processes of government, including regulatory development.

An informed and educated public provides a better pathway to successful large-scale project implementation. While many states have public participation processes that involve formal public hearings, very few have processes for conducting public outreach in an informal setting prior to the receipt of a permit application. Such proactive public outreach will be a critical tool in gaining acceptance of geosequestration as a viable technology for curbing CO_2 emissions. Formal hearing processes allow for public input once a permit application has been received. In contrast, public outreach efforts inform the public about the risks and rewards of geosequestration and proactively seek public "buy-in" on projects before they are initiated. While some would argue that public education is primarily the responsibility of the permit applicant, it will be important that regulators and the regulated community work together on education efforts that will help the public understand the need for geosequestration. Holding public outreach sessions, like the one shown here, can alleviate concerns that might otherwise lead to contentious public hearings and objections to permit applications.

In its November 2008 report titled "Guidelines for Carbon Dioxide Capture, Transport, and Storage," World Resources Institute pointed out that conducting risk analysis activities for each phase of a geosequestration project was important to its overall success.[13] Using these analyses to provide information to the public may lessen concerns that are a natural response to unfamiliar concepts or new technologies.

State Needs

Development of proactive public outreach programs will be essential to the successful implementation of geosequestration. This need is partly discussed in the next section on training because the special talents needed to conduct informal public meetings, in a sometimes hostile setting, may not be the same as those for conducting formal hearings. At present, public participation in the six study states is limited to formal hearing processes. Only the Kansas Corporation Commission, which currently has a multi-agency advisory board that includes a public member, has a statutory vehicle for Class VI public participation.

Historically, most agencies viewed public notification as the responsibility of the industry proposing a project as opposed to the entity in charge of project approval. However, it is no longer sufficient for agencies to obtain input or feedback using only public hearings processes. Proactive and participatory efforts with interested stakeholders will become an increasingly important part of successful regulatory

programs. Agencies also may find it necessary to change the mindset of having all or most hearing functions in the agency headquarters instead of at the proposed project location. Efforts to make the development of geosequestration regulatory programs as transparent to the public as possible will be critical to the effective implementation of those programs.[14]

Training

Background

When a regulatory agency is assigned a new program to administer, it has a choice of retraining existing staff or hiring additional qualified personnel to effectively implement the program. Existing staff generally has a command of the principles and procedures of how the agency desires to conduct regulatory activities. Newly hired technical staff may have the professional background to review applications or analyze data on monitoring reports but need training on the principles of regulation and the recognition of which regulatory elements are most important to achieve program quality. Without the proper balance between technical review and an awareness of regulatory principles, these reviews may turn into cautious research projects that unnecessarily delay application approval.

The scientific and technological aspects of CO_2 geosequestration are developing at an accelerating rate in the industrial and research sectors. Regulatory agencies will be faced with developing and enhancing their technical understanding to ensure geosequestration is regulated safely, efficiently, and effectively.

1. The GWPC, EPA, IOGCC (Interstate Oil and Gas Compact Commission) and others have held workshops and seminars on geosequestration topics such as well construction, MMV, and site characterization, which represent an introductory level of training. Since few states have passed legislation nor promulgated rules on geosequestration, attendees at such training events may not be those who eventually administer the programs. None of the study states has a formal training program designed to cover the specific technical aspects of geosequestration. This is not surprising since the federal UIC Class regulations are not yet in effect. Most current UIC training is conducted as an "on the job" learning activity with some supplemental training such as EPA's "UIC Inspector Certification Course." This method of training will not be adequate to the task of imparting the depth of technical knowledge needed for regulating a geosequestration program.

State Needs

States will require a program for assessing needs and developing, providing, and evaluating training. The elements of training modules should be developed concurrently with the final promulgation of the EPA Class VI program.

Required training will fall into two categories:

- **Technical training** addresses skills related to regulating the technologies and practices of geosequestration. This training should include aspects of geosequestration that require professional expertise in disciplines such as geology, hydrogeology, well completion or construction, geophysics, and reservoir engineering. Although many state agencies have personnel with expertise in these disciplines, those charged with implementing the regulation of a geosequestration program will probably need enhanced technical training in some or all of these

areas to fulfill their responsibilities for a Class VI program. Agencies such as the TCEQ or WDEQ that currently administer Class I primacy programs for hazardous disposal wells may already be routinely reviewing permit applications for a majority of the technical elements anticipated for a Class VI project. However, UIC technical staff trained to review Class II applications generally have not had to review applications for many of these elements. Additionally, operators of Class VI facilities may or may not have sufficient information on the type of technical data needed by state agency personnel that will allow state permit reviewers to make informed decisions or provide for meaningful technical discussions with applicants so that applications are not unnecessarily delayed for approval or denied.

- **Programmatic training** addresses the legal, administrative, permitting, fiscal management, and operational aspects of geosequestration. Formal programmatic training of the regulated community in the regulatory process (e.g., permitting, public notice, and hearing protocol) is not being conducted in any of the study states for currently administered UIC programs. Since geosequestration will require a public outreach program that extends beyond the formal hearing arena, training in conducting public meetings will be necessary. Public acceptance of a project may depend as much on the manner of presentation as on technical merit. Agency field inspectors will also need training in any new elements of field observations and monitoring measurements that are applicable to Class VI but not included in current UIC program activities.

Program Development Recommendations

The following recommendations should be considered regarding state CO_2 geosequestration regulatory program development.

Recommendation 1

State actions prior to seeking primacy should include the following:

1. Use current Class I application processing times to estimate the amount of time involved in performing review. Use the proposed Class VI regulations as an inventory list for mock reviews and include added time for those technical items not currently done as a part of the UIC program.
2. Provide top-echelon agency administrative personnel with estimates of what additional costs might be required to expand public outreach programs beyond the formal hearing process to public meeting venues.
3. Develop a stakeholder workgroup including legislators (as done in West Virginia and Wyoming) to scope out the needs of geosequestration regulation that exceed current program needs.

Recommendation 2

Ideally, legislation should include language that provides the following:

1. The authority to regulate and promulgate regulations for CO_2 geosequestration.
2. A mechanism for funding the program through dedicated funds, permit fees, and penalty payments by operators, directly related to field enforcement if possible. Funding considerations should evaluate full program oversight, including permitting, monitoring, data management, inspections, closure, post-closure monitoring, and long-term liability.
3. Clear guidance and regulations on financial assurance requirements, including a demonstration of how the agency intends to escalate financial assurance amounts to account for inflation.
4. Specifications regarding pore space ownership and correlative rights (if appropriate).
5. A clear statement regarding the liability of the state with respect to long-term storage (if applicable).

Recommendation 3

Regulatory language should include:

1. Specifications that are at least as stringent as those contained in the EPA proposed UIC Class VI rule.
2. Specific requirements for technical, legal, or administrative elements of the regulation (only where necessary to ensure compliance).
3. Correlative guidelines, manuals, environmental impact statements, or other documents (where allowed by state law) designed to provide programmatic guidance to both the agency staff and regulated community.

Recommendation 4

Staffing and funding estimates for implementation of a geosequestration program should be based on appropriate analogs such as the Class I Section 1422 UIC program rather than a Class II Section 1425 program, and should be estimated at levels of effort commensurate with expected numbers of projects. Estimates should include costing for staff and staff training, equipment, supplies, IT management, hard records storage and retrieval, reporting management, legal services and actions, administrative costs such as public outreach and hearings, testing, monitoring measuring and verification, modeling, financial assurance management and overhead. Further, funding analyses should account for both expected program growth and inflation.

Recommendation 5

A model public outreach program for geosequestration regulation designed to inform the public in advance of development in a specific area should be created, customized on a state-by-state basis, and implemented as part of the regulatory development process. This should include the preparation, distribution, and explanation of printed and electronic materials detailing the policy, technical, legal, and administrative processes involved in regulating geosequestration. Agencies should work closely with the regulated community, county and local governments, and community organizations to assure public outreach processes involve as many interested stakeholders as possible, as early as possible in the development/permitting of a geosequestration project. Agency policies and guideline materials used in regulatory implementation should be included in public outreach discussions. Strategies for public outreach might include:

1. Development of a well-publicized state geosequestration website page or pages that provide technical information in layman-friendly terms.
2. Maintaining lists of state, county, and local officials to be contacted regarding geosequestration projects, with staff assigned to keep those lists current.
3. Maintaining public feedback systems, such as electronic bulletin boards or blog postings.
4. Development of an issue-response team whose purpose would be to answer questions and resolve concerns before, during, and after the geosequestration project permitting process.
5. Well-publicized public comment period and procedures for offering formal comments.

Recommendation 6

Training programs should be developed and implemented and should include the following elements:

Permitting staff training

1. Injection-well technology and mechanical integrity testing
2. Flow characteristics of CO_2 in the subsurface and flow modeling
3. Effects of CO_2 on surface and downhole equipment
4. Interpretation of geophysical and other logs required of project operators
5. Monitoring, measuring, and verification methods
6. Elements of plugging plans for CO_2 sequestration wells.

Field staff training

1. Safety procedures at CO_2 injection operations in accordance with a required operator project Safety Plan
2. Effects of CO_2 on surface and downhole equipment
3. Injection-well technology and mechanical integrity testing where the testing requirements for sequestration differ from those currently applicable for other classes of UIC wells witnessed by agency staff
4. Well-plugging materials and methods where different for CO_2 sequestration wells
6. Emergency response procedures used in addressing well malfunctions or CO_2 releases.

Management and policy staff training

1. Public outreach and interaction
2. Project planning and administration
3. Conflict resolution.

Industry staff training

1. Permitting processes
2. Public participation
3. Records retention and management
4. Reporting
5. Field inspections
6. Well testing
7. Monitoring, measuring, and verification
8. Well plugging
9. Site closure
10. Financial assurance
11. Post-site-closure monitoring and management.

Recommendation 7

A model primacy application, customizable to meet individual state needs, should be developed and provided to states that want to pursue primacy for the Class VI program. Additionally, customization assistance should be provided on an as-needed and funded basis.

References

[1] GWPC Initiatives to Assist States with UIC Measures Information Management and Resource Assessment and Capacity Building, Ground Water Protection Council, 2004, 8 pp.

[2] "Guidelines for Carbon Dioxide Capture, Transport, and Storage," World Resources Institute, Washington, D.C., WRI 2008, 144 pp.

[3] "Policy Brief: Comprehensive Regulation of Geologic Sequestration," Carbon Capture and Sequestration Regulatory Project, Department of Engineering and Public Policy, Carnegie Mellon University, July 20, 2009, 7 pp.

[4] "Policy Brief: Learning and Adaptation in Regulation of Geologic Sequestration," Carbon Capture and Sequestration Regulatory Project, Department of Engineering and Public Policy, Carnegie Mellon University, August 28, 2009, 7 pp.

[5] "INJECTION WELLS: An Introduction to their use operation and regulation," Ground Water Protection Council, 2005, 16 pp.

[6] CROMERR Federal Register Notice Preamble and Regulation (PDF) (43 pp, 520 K); Final regulation and preamble as published in the Federal Register on October 13, 2005.

[7] "The 2009 Greenhouse Gas and Climate Change Workforce Needs Assessment Survey Report," Greenhouse Gas Management Institute, 2009, 32 pp.

[8] "INJECTION WELLS: An Introduction to their use operation and regulation," GWPC, 2005, 16 pp.

[9] "Early Transportation of Oil," Paleontological Research Institution, http://www.priweb.org/ed/pgws/history/Pennsylvania/river_scene.html.

[10] "Early Transportation of Oil," Paleontological Research Institution, http://www.priweb.org/ed/pgws/history/Pennsylvania/river_scene.html.

[11] "Will Water Issues/Regulatory Capacity Allow or Prevent Geologic Sequestration for New Power Plants? A Review of the Underground Injection Control Program and Carbon Capture and Storage," American Public Power Association and the Policy Navigation Group, 2007, 25 pp.

[12] "Evaluation of State and Regional Resource Needs to Manage Carbon Sequestration Through Injection," Argonne National Laboratory, Environmental Science Division, June 2007, 81 pp.

[13] "Guidelines for Carbon Dioxide Capture, Transport, and Storage," WRI, November 2008.

[14] "Geologic CO_2 Storage—Can the Oil and Gas Industry Help Save the Planet?" Steven Bryant, SPE, University of Texas at Austin, SPE distinguished Author Series, September 2007, 11 pp.

Appendix A. Study Methodology and Design

This report—developed by the Ground Water Protection Council at the request of the DOE, Office of Fossil Energy, National Energy Technology Laboratory—assesses the needs of states in implementing a UIC regulatory program for large-scale CO_2 geosequestration. Focus is on four main topics:

- Legislation
- Administration
- Program management/implementation
- Information technology.

Within these areas, several sub topical issues emerged, including:

- Legislative authority and direction
- Regulatory language
- Interagency coordination
- Staffing and funding
- Data management capacity and capability
- Public outreach and education
- Technical and regulatory training.

In some areas, such as legal authority and regulatory language, needs could be ascertained within a degree of relative certainty. In others, such as staffing and funding, the picture is less clear and requires more of a "reasonable estimate" approach. For example, since there is no current Class VI UIC geosequestration program in place in any state, the staffing and funding needs for such a program must be based on an appropriate analog. Using the specifications contained in the proposed Class VI UIC rule currently under consideration by EPA, the best available analog is the Class I UIC program.[1] Consequently, staffing and funding assessments in this report rely on:

- State-supplied information on staffing and costs for existing Class I programs
- Estimates of additional Full-Time Equivalents (FTEs) needed to implement a Class VI UIC program within existing Class I UIC primacy agencies
- Estimates of additional FTEs needed to implement a Class VI or equivalent UIC program within existing Class II UIC primacy agencies
- Estimated time expended by Class I staff in processing applications from time of filing through final approval.

The Ground Water Protection Council (GWPC) used the following four-step process to evaluate the needs of state agencies and prepare this report:

- **Selecting project team.** The GWPC developed a multidisciplinary, multi-stakeholder project

[1] 40 CFR Parts 144 and 146 Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO_2) Geologic Sequestration (GS) Wells, Proposed Rule, Federal Register / Vol. 73, No. 144 / Friday, July 25, 2008 / Pages 43492-43541.

team to ensure stakeholders from appropriate interest groups were consulted with respect to the development of the study parameters, goals, surveys, questionnaire contents, and report. The team consisted of members of state regulatory agencies, national laboratories, non-governmental organizations, and the power generation industry. *(NOTE: See the list of project team members shown at the beginning of the report.)*

- **Administering state questionnaire and selecting study states.** In October 2009, the GWPC held a Risk Based Data Management System (RBDMS) meeting in Denver, Colorado. In conjunction with this meeting, a group of state regulatory officials, data managers, Regional Partnership representatives, and consultants developed a questionnaire to send to state regulatory agencies. The purpose of the questionnaire was to evaluate the current position of each state with respect to their regulatory intentions, current capacities, and knowledge and expertise relative to implementation of a UIC geosequestration program. The questionnaire sought information in the areas of legislation, administration, program management/implementation, and information technology. The questionnaire was sent to 53 state agencies, and 20 (shown in Table 4) submitted responses. Based on these responses, the GWPC selected six study states to participate in follow-up interviews (Kansas, Michigan, Mississippi, Texas, West Virginia, and Wyoming). Responses to the initial questionnaire from the six study states are included as Appendix B.

Table 4. States Responding to the Questionnaire

State	Agency	UIC Type
Alabama	Alabama Oil and Gas Board	Class II
Alaska	Alaska Oil and Gas Commission	Class II
Arizona	Arizona Oil and Gas Conservation Commission	Class II
Florida	Florida Department of Environmental Protection	Class I
Idaho	Idaho Division of Water Resources	Class I
Illinois	Illinois Division of Oil and Gas	Class II
Indiana	Indiana Division of Oil and Gas	Class II
Kansas	Kansas Corporation Commission	Class II
Kentucky	Kentucky Oil and Gas Conservation Commission	Class II
Louisiana	Louisiana Office of Conservation	Class II
Michigan	Michigan Department of Environmental Quality	Class II
Mississippi	Mississippi Department of Environmental Quality	Class I
Mississippi	Mississippi Oil and Gas Board	Class II
Nebraska	Nebraska Department of Environmental Quality	Class I
Nebraska	Nebraska Oil and Gas Commission	Class II
New Mexico	New Mexico Oil Conservation Commission	Class II
Oklahoma	Oklahoma Department of Environmental Quality	Class I
Texas	Texas Commission on Environmental Quality	Class I
West Virginia	West Virginia Department of Environmental Protection	Class II
Wyoming	Wyoming Oil and Gas Conservation Commission	Class II

- **Follow-up interviews with study states.** During March 2010, the project team developed a set of 45 follow-up interview questions. Follow-up phone interviews of technical and policy staff from participating UIC programs in each study state were conducted by two members of the team between April 19 and April 27, 2010. The list of follow-up questions and a summary of state responses to each is included as Appendix B. *(NOTE: The Texas Railroad Commission representative could not participate verbally in the follow-up interview process but subsequently submitted written responses to the follow-up questions.)*
- **Conducting independent research.** Reviews of scientific, technical, legal, regulatory, and fiscal documents were also conducted to support the development of the needs assessment. These reviews included papers and reports prepared by national laboratories, universities, geosequestration partnerships, state agencies, federal agencies, and private consultants.

Each of the six study states is in a different phase of regulatory development. For example, Wyoming has passed legislation and promulgated regulations to manage CO_2 geosequestration. Texas has passed legislation and is currently promulgating regulations. Mississippi and Michigan have not yet proposed legislation. Kansas has passed legislation and promulgated regulations, while West Virginia has passed legislation and formed a CO_2 Workgroup, but has just begun the process of regulations development. The study states also vary from geographic, climatic, demographic, and agency organizational standpoints, and in their source/sink potential. For example, Texas has a significant amount of storage capacity in mature oil and gas fields and deep saline aquifers, while West Virginia has a smaller amount of storage space in mature oil and gas fields, but a significant amount of deep saline aquifer storage capacity.[2] West Virginia also has a large CO_2 source base because the Ohio Valley is home to a great number of coal-fired power plants. Conversely, Wyoming has a substantial amount of mature natural gas field capacity, a relatively large volume of saline aquifer storage capacity potential, and a source potential that is widely separated geographically due to a relatively small population with lower industrial and power generation density.[3] Kansas also has a large number of mature oil and gas fields and a large saline storage capacity in paleo-karst section of Mississippian and Cambro-Ordovician rocks.

Given such variations among states, not all recommendations in this report apply to every state. It is important to review recommendations in the context of each state's unique situation and the content of the proposed Federal Class VI UIC regulation.

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[2] Carbon Sequestration Atlas of the United States and Canada, U.S. Department of Energy, Office of Fossil Energy, National Energy Technology Laboratory, March 2007, 86 pp.

[3] *Ibid*.

Appendix B. Summary of Study States Follow-up Interview Responses

1. **Will jurisdiction for geosequestration reside in one agency or multiple agencies in your state? (Please describe the breakdown if more than one agency will have control.)**

   Kansas KCC: The 2007 Legislature gave jurisdiction to KCC, but they will have a MOU with KDHE for the 1422 Class VI program. KCC will seek primacy for Class VI.

   Michigan DNRE: No program yet, but will probably be under DNRE. Office of Geological Survey has state jurisdiction over UIC wells but no EPA delegated primacy any UIC well Class. Pipelines are under the Public Service Commission and Air is under the Air Quality Division of DNRE.

   Mississippi O&GB and DEQ: Not known yet for Class VI. EOR would probably stay with O&GB. Could be single agency or joint authority.

   Texas CEQ: The TCEQ has jurisdiction over other geologic storage of anthropogenic carbon dioxide in deep saline formations not associated with the potential for oil or gas production. There are some jurisdictional gray areas in the law.

   Texas RRC: The RRC has jurisdiction over geologic storage of anthropogenic carbon dioxide in, and the injection of anthropogenic carbon dioxide into, a reservoir that is initially, is or may be productive of oil, gas, or geothermal resources or a saline formation directly above or below that reservoir.

   West Virginia DEP: Division of Water and Waste Management UIC program. A permit for the well work will be required from the Division of Mining. All part of DEP. Committee will decide on authority for well work permits for Class VI. (Carbon Capture and Sequestration Working Group)

   Wyoming DEQ: WDEQ will have responsibility for Class VI. If some or all CO_2 wells are put into a new well class for joint geosequestration and enhanced oil recovery, then a decision would have to be made as to whether the Wyoming Oil and Gas Commission (WOGC) would have jurisdiction since they have Class II primacy.

2. **Please describe your rule promulgation process (steps, approval authority, timing).**

   Kansas KCC: Class VI CO_2 storage rule promulgation during 2007–2009 followed the general regulatory procedure in Kansas. Once statutory authority is attained, the KCC then forms a work group of knowledgeable parties from the Statutorily mandated KCC Oil and Gas Advisory Committee. In the case of CO_2, this was KCC, Kansas Department of Health and Environment (KDHE), Kansas Geological Survey (KGS) and members of the utility industry. The regulations were drafted, sent to the O&G Advisory Committee and after initial review by the Commission, went to the Department of Administration (context approval) and the Attorney General (legality). After these two entities approve the regulation s and changes are made, they then published in the Kansas Register and given a 60-day period for public comment which closes with the final hearing by the Commission. If the Commission approves the regulations. as written, they become in effect at that time. If changes are made, the above administrative process is revisited. The KCC Conservation Director or attorney also will appear at some point before the Joint Legislative Committee on Rules and Regulations, wherein questions are asked and recommendations are made. Should KCC not incorporate legislative recommendations, the Legislature can impose change by bill introduction.

   Michigan DNRE: Administrative Procedures Act governs rule promulgation. Rule drafted by DNRE staff; goes to public hearing. Rules then go to joint legislative committee on administrative rules. If

no objection, proceed with promulgation after 28 days and subsequently certified by great seal of the governor(?). Total time for non-contested rule development—one year.

Mississippi O&GB: Staff drafts rule which then goes through public notice and docketing with a comment period for 60 days. After O&GB approval, it becomes effective 30 days after delivery to Secretary of State.

Mississippi DEQ: Follows similar procedure as O&GB except that they conform to EPA's procedure for promulgation. By Mississippi law, DEQ rules cannot be more stringent than EPA.

Texas CEQ: A project manager is named and team formed to draft a rule, which is then placed on the commission agenda for approval band published in the Texas Register for 30-day comment period. A public meeting is offered. Final draft is taken to the Commission for adoption and becomes effective 2–3 weeks after approval.

Texas RRC: Proposal to Commission for permission to publish in the Texas register for formal comment. Usually 30 days for comment (actually 47 days because it takes 17 days for publication.) Staff reviews comments after comment deadline and makes changes as appropriate. Staff takes the proposed final rule to conference for final adoption. Rule effective 20 days after adoption.

West Virginia DEP: Written by staff, checked by legal staff, Submitted to legislature, reviewed by legislative divisions, approved by legislature, then governor's signature. WV has developed a CO_2 geosequestration committee made up of environmental interests including oil and gas. Report from committee to legislature is due July 1. The committee will be charged with developing a framework for the legislature about how the regulations should be structured. Committee will cover issues such as bonding, data management. Target for regulations for CO_2 not yet established but should be in next 2–3 years.

Wyoming DEQ: Rule is drafted by staff and presented to the Water and Waste Advisory Board (30 day prior notice). WWAB holds one or more public hearings to receive comment. Once approved by WWAB, rule is taken before the Environmental Quality Council (EQC) (45-day prior notice) which also holds public hearings for comment. Once EQC recommends rule adoption, rule goes through DEQ Director to Governor, with the Attorney General and Legislature allowed to make comments. Rule effective upon Governor's signature or date identified in the rule.

3. Please list your current or pending regulations and legislation (citations, dates approved/effective).

Kansas KCC: KSA 55-1635 to 55-1640 Effective 7/1/2007 and KAR 82-3-311A, KAR 82-3-1100-82-3-1120, Effective 2/2010. (CO_2 Underground Storage, Class VI)

Michigan DNRE: None likely. Wells likely governed under mineral wells statute.

Mississippi: Legislation should be introduced in 2011.

Texas CEQ: Senate Bill 1387, 81st Legislative session. The bill charges the TRRC to establish technical rules by September 1, 2010. TRRC rules should be consistent with Federal Class VI rules and they should apply for primacy. Also requires a letter to TCEQ to determine if the injection zone is a fresh water zone. This will require TCEQ to review each application. This will also include the AOR, corrective action plan, site monitoring plan and post site care plan. Both agencies were assigned to develop a joint report to describe their activities and point out any problems.

Texas RRC:
–Rule 9, Rule 46, Fluid Injection into Productive Reservoirs
–Rule 81
–Chapter 27, Water Code
–Texas Administrative Code, Title 16. Economic Regulation, Part 1. Railroad Commission of Texas, -
–Chapter 5, Carbon Dioxide (proposed)

West Virginia DEP: HB 2190, 2009 Legislature.

Wyoming DEQ: WS35-11-313 Effective 7/1/2008. Chapter 24 of Water Quality Division Rules and Regulations (draft). Not yet effective. (Through Board and scheduled for EQC in July.)

4. What is your current annual budget for the UIC program?

Kansas KCC: Class II 1425 program (salary and fringe only) $830,800

Michigan DNRE: Doesn't split out UIC costs. Total budget is $10 million of which $7 million is for oil and gas regulation.

Mississippi O&GB: $435,737

Mississippi DEQ: $122,000

Texas RRC: Federal funding for the Oil and Gas Underground Injection Control (UIC) program was created on the basis of a 75% federal share with a 25% general revenue state share. Due to federal funding limitations the state share represents closer to 65% of the UIC funding. It varies from year to year. FY10 we received $801,845, of which $131,303 is for the W-14 scanning and $7,672 was for travel to a training held in Dallas last October.

West Virginia DEP: Class V program has an annual budget of $1.4 million.

Wyoming DEQ: Roughly $400,000 for 1422 Class I, III and V programs.

5. What is the total annual amount of federal funding you receive for your UIC program?

Kansas KCC: Class II -$351,000 for FFY 2010.

Michigan DNRE: Non-primacy state (no federal funding).

Mississippi O&GB: $103,000

Mississippi DEQ: $70,400

Texas RRC: See answer to 4 above.

West Virginia DEP: $311,000

Wyoming DEQ: $174,000 for 1422 and $197,000 for 1425.

6. Does your funding come from dedicated funds, general funds or a combination of both?

Kansas KCC: Oil and gas production fee (dedicated conservation fee based on volume produced, not price/bbl or mcf.) Also have UIC application filing fee. Established by regulation with no statutory cap.

Wyoming DEQ: EPA grant and State general fund. Legislation allows for a permit fee. Will use Class I fund analog for Class VI.

Michigan DNRE: Restricted funds from a surveillance fee on production value. Per annual fee on mineral wells.

Texas CEQ: Dedicated funds (Waste generation fees). New funding for CO_2 program.

Texas RRC: General funds.

Mississippi O&GB: General fund. Plugging fund from bonds + $0.5 million for unplugged well fee.

Mississippi DEQ: General fund.

West Virginia DEP: Dedicated authority for current program and authorized for CO_2 geosequestration.

7. **Do you have the authority to establish fees for services or activities (such as annual well fees, injection volume fees, etc.)?**

Kansas KCC: See 6 above for current Class II. Separate fee structure for CO_2 wells (5 cents per ton of CO_2 injected for program FTE support, program management, and remediation.

Michigan DNRE: No. Legislative authorization would be required.

Mississippi O&GB: Plugging funds are established by rule for the O&G regulatory program.

Mississippi DEQ: No.

Texas CEQ: Yes, but for only existing activities. This would not apply to the reviews of Class VI applications that are under the jurisdiction of TRRC that must be done by TCEQ.

Texas RRC: Yes.

West Virginia DEP: Yes.

Wyoming DEQ: Yes. Applicants shall pay fee based on costs of application process (Statutory). Also, a special revenue account is to be established (based upon other fees) to cover the costs of long-term MMV by DEQ.

8. **Have you undertaken any analysis of the cost to your state of implementing geosequestration regulation? (If yes what is your estimate of the startup and annual costs?)**

Kansas KCC: No cost analysis done yet.

Michigan DNRE: No.

Mississippi B&OG and DEQ: No.

Texas CEQ: No. A bill analysis of SB1387 was done.

Texas RRC: FY 2010; $141,500 + $32,700. Subsequent fiscal years $136,728 + $ for contract with Bureau of Economic Geology.

West Virginia DEP: No. Geosequestration Committee charges to look at both program costs and costs of state closures.

Wyoming DEQ: No. The working group recommended addition of 2 environmental and scientific FTE's and one clerical FTE to develop financial assurance regulations.

9. How many UIC permits did you issue annually over the past 3 years?

Kansas KCC: 1,425 Class II permits.

Michigan DNRE: Issued 20–25 Class II permits and one from another class.

Mississippi O&GB: New wells in past three years—334; Class II conversions—660.

Mississippi DEQ: Renewals in two Class I projects—7; 1 Class V Experimental well.

Texas CEQ: 2007—8 for five projects; 2008—12 for 7 projects and 2009—25 for 12 projects.

Texas RRC: FY07: Class II—1,143 (2,106 wells); FY08 Class II—1,238 (2,214 wells); FY09 Class II—1,985 (3,713 wells).

West Virginia DEP: Class V wells 284 from 2007–2009.

Wyoming DEQ: 3–4 Class I permits with about 12 wells (area permits).

10. Describe the current public comment period for UIC permits (timing, duration etc.), and do you expect it to be the same for geosequestration permits?

Kansas KCC: 30-day protest period with no change for Class VI. Protest period culminates with application being placed on the Commission hearing docket.

Michigan DNRE: For Class II there is an opportunity for comment on applications but not a formal application comment period. For non-oil and gas injection well applications, a comment period of at least 30 days is allowed and a hearing is held regardless of the amount of public comment.

Mississippi O&GB: 20 days for Class II EOR; 30 days for Class II-D.

Mississippi DEQ: 30 days plus hearing in the area of the facility then additional thirty days. Application then to board for permit issuance.

Texas RRC: The RRC's Practice and Procedure Rule 201 sets specific time limits for RRC staff to act on permit applications. UIC staff has 30 days to complete the initial review or the application. UIC staff must request additional data if the application is incomplete or notify the applicant that the application is administratively complete. If the application involves injection of fresh water, an additional 30-day review period is allowed for TCEQ review. UIC staff has 15 days to complete the final review and the notification process ensures that all affected parties are informed and have opportunity to protest the permitting of the proposed injection well.

The rules for Class II injection wells provide a minimum fifteen-day opportunity for protest. The 15-day period begins on the latest of three dates: (1) the date the application is received by the Commission with the appropriate fee; (2) the date notice is mailed or delivered to the surface owner, offset operators, and city/county clerks; and (3) the date notice is published. A protest may be filed anytime before the permit is issued.

If an application must go to hearing, final action on the application can be delayed by several months.

Staff expects the Class VI injection well applications to take longer because the proposed rules include additional material that will require staff review, notification of additional persons, and the required letter from the Executive Director of the TCEQ regarding fresh water sands.

West Virginia DEP: 30 days from issue of public notice period. Likely same for Class VI.

Wyoming DEQ: 30-day public comment period for Class I and 60-day comment period for Class VI.

11. **Assuming no objections to a permit application are received, how long does it take to issue a UIC permit? (Class I, II, III, V)**

Kansas KCC: Class II—45 days.

Michigan DNRE: For state duplicated applications for Class I–V, 50 days maximum by statute.

Mississippi O&GB: Class II—20 days.

Mississippi DEQ: Class I—60 days.

Texas CEQ: Class I, Internal standard of issuance within 390 days from receipt assuming no public comment. Minimum time for processing—8 months. Estimate similar times for CO_2 Class VI.

Texas RRC: Class II, target of 45 days and Class III, 60 days. Officially bound by 16 TAC 1.205. Had a hard time meeting statutory time line in 2009 due to turnover of technical staff.

West Virginia DEP: Class I, 60 days including comment period.

Wyoming DEQ: Class I, 60–90 days for an application that does not require additions, corrections or changes.

12. **Do you have the authority to deny permits and under what circumstances may a permit be denied? (Examples might include enforcement action, application insufficiency or incompleteness, formerly revoked permits, insufficient demonstration of ability to contain injectate, risk of endangerment to USDWs etc.)**

Kansas KCC: Applications can be formally denied for Area of Review problems, if corrective action is not taken in accordance with Commission Order, potential endangerment of fresh water or USDWs or correlative rights violation potential. Failure to maintain a license is a basis for denial, however, pending corrective action or other activities of the same applicant is not. Applicant can always ask for a hearing if aggrieved. Similar criteria to be implemented for Class VI.

Michigan DNRE: Proposed injection into a zone without proper isolation from fresh ground water. Active enforcement action s and some surface issues.

Mississippi O&GB: Insufficient protection of base of fresh water, not for enforcement of outstanding violations.

Mississippi DEQ: Insufficient protection of USDWs, failure to perform corrective action on wells in AOR, transmissive faults or other geologic criteria. Applicant has to convince DEQ that underground injection is the best method of disposal in a hierarchy system. DEQ prohibits Class I commercial hazardous waste wells.

Texas CEQ: State law requires review of applicant's compliance history. Poor performance history with TCEQ can hold up an application but denial requires a commission determination. Before administrative review (AR) an application can be returned to the operator if TCEQ staff has notified of needed changes and no response is received. After AR, only the Commission can deny an application.

Texas RRC: The RRC has authority to deny permit applications, for application insufficiency or incompleteness, if the proposed well completion or operating conditions do not meet minimum standards, the operator fails to show that the formations are separated from freshwater formations by impervious beds which will give adequate protection to such freshwater formations, the applicant fails to provide a letter from the TCEQ stating that the use of such formation will not endanger the

freshwater strata in that area and that the formations to be used for disposal are not freshwater-bearing, insufficient demonstration of ability to contain injectate, risk of endangerment to USDWs, etc.

West Virginia DEP: Yes, for non-compliance with any permit, failure to disclose relevant facts or misrepresentation, endangerment of human health and the environment. If corrections are made, DEP will typically re-process the application.

Wyoming DEQ: Regulation establishes basis for Class I UIC permit denials (Chapter 13 WQD Rule, Section 7) Similar requirements for Class VI will be in proposed Chapter 24, Section 4, paragraph b.

13. **Are you required to hold formal hearings as a result of objections to a permit application or application denial and what is the threshold for this requirement? (e.g., number of objections, source of objections, etc.)**

Kansas KCC: All requests for hearing are honored as significant. Informal discussion is allowed. In some cases, pre-filed testimony is required by the applicant whose issue is being protested.

Michigan DNRE: For Class II where a verified statement of objection is submitted, an evidentiary hearing is required. For other classes of wells, a hearing is allowed but not mandatory.

Mississippi O&GB: For disposal wells, objector must file in writing a contest at least 9 days before a hearing.

Mississippi DEQ: Public hearing. Complaints offered as testimony at the hearing or received within 30 days following the hearing are taken under advisement. Recommendations are subsequently made to the Board. An evidentiary hearing can be requested of the Board.

Texas CEQ: Under Texas law, the Commission determines whether or not a person is an affected person entitled to a contested case hearing. The State Office of Hearing Officers hears the cases.

Texas RRC: If a protest is received from an affected person or a governmental entity, the RRC cannot administratively issue a permit. A hearing is scheduled at the request of the applicant. RRC rules define an affected person as "a person who has suffered or will suffer actual injury or economic damage other than as a member of the general public, and includes surface owners of record of property on which the well is located and adjoining offset operators."

West Virginia DEP: At the discretion of the Direction of DEP (Cabinet level), based on request for hearing. Requests are usually granted for anything deemed significant.

Wyoming DEQ: Public hearings are requested during a 30-day review period. Must be made in writing and state reasons for request. The administrator has discretion to hold hearings based on the details in the request, and the amount of public interest. Appeals of issued permits are allowed. Appeals are made to the DEQ Director and the EQC. Appeals process administered under the Administrative Procedures Act.

14. **If a formal hearing is held do you require the objector to either:**

    a. **Be present; or**
    b. **Be represented by council or a third party**

Kansas KCC: Yes. Protestor is required to be present if a person or by an attorney if a corporation.

Michigan DNRE: Protesting party must be present for evidentiary hearings but not for public hearings. Only corporations are required to be represented by attorneys.

Mississippi O&GB and DEQ: Both require objector to be present or be represented by an attorney.

Texas CEQ: Operator does not have to be present but can have attorney represent him. Corporations must be represented by counsel.

Texas RRC: The objector must attend or be represented at the hearing.

West Virginia DEP: Objector does not have to be present. Can be represented by an attorney but not required, even for corporations.

Wyoming DEQ: Objectors do not have to be represented by counsel for draft permits but may have to be present for some appeals.

15. Does or can your agency hold informal meetings/hearings outside of a formal administrative process?

Kansas KCC: Yes. Informal meeting with operators; pre-hearing conferences and settlement meetings.

Michigan DNRE: Informal meetings are allowed.

Mississippi O&GB: Yes, pre-hearing conference a week before the board hearing. Staff allowed to ask questions but not allowed to express opinions.

Mississippi DEQ: No, hearing process only.

Texas CEQ: TCEQ does hold public meetings based on objections to an application. A participant can request a contested hearing, which must be determined by the Commission. There is also an alternative dispute resolution process available.

Texas RRC: Yes.

West Virginia DEP: Yes.

Wyoming DEQ: Yes

16. Describe the method used to assign inspection areas. (e.g., geographic, well type, duty type (i.e., MITs, plugging, etc.)

Kansas KCC: The KCC Conservation Division maintains four field offices throughout the state which are geographically located to accommodate the distribution of oil and gas leases. The district staff implements all field program responsibilities of the KCC. Class VI field activities will be carried out in a similar manner.

Michigan DNRE: Inspectors are assigned geographically to 3 District Offices and 2 Field Offices. There is one Field Office in the Northern Peninsula where there is no oil or gas. Programs are integrated (UIC and non-UIC).

Mississippi O&GB: Have 7 inspectors who are located geographically throughout the state and work out of their homes.

Mississippi DEQ: One FTE statewide, located in Jackson.

Texas CEQ: Network of 14 regional offices with inspections assigned from the offices. Inspectors are supervised by Office of Enforcement and Compliance and are not supervised by personnel in specific program areas responsible for permitting. MITs are managed by only two regional offices for the entire state.

Texas RRC: TRRC has _14(?)_ district offices which does field inspection for all regulatory duties for the Commission. Field Operations is supervised by a separate person in Austin and not by the manager of a particular program area (UIC Class II, Plugging e.g.). Responder provided a fairly detailed outline of the Four Priority areas which are inherent guidelines for the district staff to use in planning workload. The General Guidance is as follows:

GENERAL GUIDANCE
Until staffing levels improve we will continue to use this guideline to select the types of field jobs we perform. This may significantly reduce some of the fieldwork we currently do such as "general lease inspections" in non-sensitive areas. In dealing with our clients, never use our limited staffing problem as an excuse for not doing a good job. Use the positive approach that we are doing the best we can, but could do even more with increased funding and staffing levels.

Prioritization of jobs will be based on several factors including, established performance goals, proximity to public/environmentally sensitive areas, unique regional/district variables, area knowledge, compliance history of operator, RRC manpower avail ability, and common sense. *(NOTE: Active Pollution/Safety Related Complaints will generally be inspected within 24 hours, and other complaints will be inspected within 24–72 hours unless other arrangements are made with the complainant.)* Agency strives to use time more productively. In order to perform more "priority" jobs district managers are encouraged to schedule field inspectors work time in such a manner as to cover as many priority jobs as possible within the constraints of flexible hours. If time permits, lower priority jobs should be performed in conjunction with higher priority jobs. In addition, "established work boundaries" must be overlooked in assigning priority jobs to inspectors who work areas with minimal priority-job activity. Utilize the sweep concept in problem areas. This will accomplish much in a short period of time toward getting an area inspected and in compliance.

West Virginia DEP: Class V—2 inspectors working out of their homes. Assigned on a geographical basis.

Wyoming DEQ: About 90% of all inspection effort comes out of Cheyenne Headquarters office. DEQ does have three district offices located in Casper, Lander and Sheridan. Inspections are assigned by priority of well type. (Class I or Class V in Wellhead Protection Areas.) Inspections are assigned on the basis of need and are done by permit staff.

17. Do you have the authority to conduct unannounced, unsupervised site inspections? (e.g., do you have right of ingress and egress onto private property for regulatory compliance purposes?)

Kansas KCC: Yes, for all wells including geosequestration. No prior notice currently required except under Surface Owner Notification Act of 2009 requirement for operators regarding well drilling, plugging, or lease transfer.

Michigan DNRE: Yes.

Mississippi O&GB and DEQ: Yes.

Texas CEQ: Yes, but this is not typically done except for a complaint response, or where the operator is in the poor performance category.

Texas RRC: Yes. Water Code, **§27.071 (POWER TO ENTER PROPERTY)** provides the TCEQ and RRC with authority to enter public or private property to inspect and investigate conditions relating to injection well or disposal well activities within their respective jurisdictions or to monitor compliance with a rule, permit, or other order of TCEQ or RRC. Members or employees acting under

the authority of this section who enter an establishment on public or private property shall observe the establishment's safety, internal security, and fire protection rules.

Water Code, **§27.072 (POWER TO EXAMINE RECORDS)** provides TCEQ and RRC authority to examine and copy those records or memoranda of a business they are investigating as provided by §27.071 that relate to the operation of an injection or disposal well, or any other records required to be maintained by law.

West Virginia: Yes.

Wyoming DEQ: Yes.

18. What is your divisions/agencies total staff count (by type)? (e.g., geologists, engineers, clerical, legal, etc)

Kansas KCC: Central Office in Wichita (Class II) has 4 geologists, 1 supervisor, 2 support staff, 1 supervisory attorney, 2 staff attorneys. The district offices have a total of 41 geologists (environmental scientist classification) and field inspectors (Petroleum Industry regulatory Technicians). District staff comments on some Class II applications in terms of AOR, lease status, e.g., but does not approve applications.

Michigan DNRE: 45 FTE geologists (mostly field staff); 1 FTE engineer and 1FTE hearing officer who is an attorney specialist on mineral law.

Mississippi O&GB: 2FTE geologists, 1 engineer, 2 environmental administrators (process permits, witness MIT's, and 2 administrative staff.

Mississippi DEQ: One geologist.

Texas CEQ: Total of 20 FTEs including field staff. About 2/3 of staff resources devoted to Class I. They have 1.5 FTEs Engineers and 7 FTEs geologists. Only engineers can review reports and work that must be submitted under an engineering seal and only geologists can review reports and work that must be submitted under a geologists seal. Legal services are obtained from the Environmental Law Division in the Office of Legal Services with 2–3 attorneys typically receiving the UIC cases (total of 1 FTE).

Texas RRC: The Railroad Commission of Texas has a legislative appropriations cap of 706.1 full-time equivalent (FTE) positions for FY 2008 and FY 2009. Oil and Gas Division has 343 FTEs. UIC has 12 FTEs directly, although other sections of the Oil & Gas Division (Field Operations, etc.) support the UIC section. The O&G Division has hired one FTE specifically for the Class VI program at this time to help with rulemaking and the primacy application.

West Virginia DEP: UIC program has 2 geologists and 1 environmental resource specialist (septic permits). No licensing required for geologists.

Wyoming DEQ: 2 geologist FTEs, 2 Engineer FTEs (primarily Civil Engineers. Who focus on Class V but work with geologists on deep wells. Clerical and legal are shared with the latter provided by the Ag's office on an as needed basis. Geologists and engineers are licensed in Wyoming.

19. Describe your system for obtaining staff training.

Kansas KCC: Mostly on the job training (OJT) for new hires. Some training by District Office compliance officers and staff attorneys on QA/QC plans and enforcement procedure. No budget for systematic training.

Michigan DNRE: OJT. No training for technical issues but some training provided for other activities such as expert witness.

Mississippi O&GB: OJT with cross training between disciplines.

Mississippi DEQ: EPA inspector certification course.

Texas CEQ: Utilize manuals and materials for OJT with a mentoring system. Also provide classroom sessions and take advantage of GWPC, EPA, Texas Bureau of Economic Geology (BEG) and other training opportunities. TCEQ has written procedures and standardized forms and documents for permit review to assist in training.

Texas RRC: As available through IOGCC, GWPC plus OJT.

West Virginia DEP: Person to person OJT. No specific UIC training.

Wyoming DEQ: OJT by existing staff. New hires usually sent to EPA inspector training course and encouraged to participate in training provided by GWPC and others. No specific training budget.

20. Estimate the number of FTEs you have devoted to the following activities: (Example: Permit application processing = 2.5 consisting of 1 full time and 3 half time)

a. Permit application processing
b. Site inspections (Includes routine, complaint response and follow-up inspections)
c. Mechanical integrity testing (Includes both field and office elements of testing)
File reviews
d. Completion report reviews
e. Plugging plan reviews
f. Witnessing of well plugging
g. Plugging documentation reviews
h. Records management (includes handling, storage, digitization, copying and distribution)
i. Enforcement actions (includes notifications, hearings, and site inspections)

Kansas KCC: Activities a., d., and e. are primarily done by Class II UIC staff in Wichita. The rest of this list would be done by district staff as needed in cooperation with Wichita program personnel.

Michigan DNRE: All categories done by most FTEs at some time or other. The attorney from the AG's office does enforcement.

Mississippi O&GB: Either central office staff or field inspectors perform these.

Mississippi DEQ: One person does everything.

Texas CEQ: About 2/3 of staff devoted to Class I program. No specific time accounting attributed to listed UIC activities.
Texas RRC: The 12 FTEs in UIC perform all of the above except for field inspections. They have 88 field inspectors.

West Virginia DEP: Most of the above are done by Class V Central office or field staff**.**

Wyoming DEQ: Answered above except that attorneys who work for the DEQ are assigned as needed.

21. Do you expect to permit geosequestration on a well-by-well or project-by-project basis or both? If project-by-project will this be done with a site plan followed by individual permits?

Kansas KCC: Project basis.

Michigan DNRE: Well-by-well.

Mississippi O&GB: Well-by-well.

Mississippi DEQ: Project-by-project.

Texas CEQ: Unless defined by legislation, individual well permits would be issued, however the applicant would be encouraged to submit sets of applications for all wells in a project with a review on that basis.

Texas RRC: Propose to permit Class VI by project by project. Permit may be amended later to add wells.

West Virginia DEP: Project-by-project.

Wyoming DEQ: Permitted by both project and individual well.

22. For UIC permits do you currently require the applicant to submit the following and under what circumstances are these required (e.g., all applications, applications in sensitive areas, etc.):

Michigan: Yes unless denoted below; **Texas RRC**: Yes for proposed Class VI unless denoted below. Texas does not do a lot of these for Class II), **West Virginia DEP**: Yes to all for Class VI except as noted below. **Wyoming** stated "yes" to all except (w) MSDS sheets for Class VI. Mostly done now for Class I because of the nature of Wyoming structural geology. **Texas CEQ**: Yes to all except (q)—proof of ownership

a. **Ground water analysis data for USDWs in the AOR;** **Michigan**
b. **Plans for the following:**
    i. **Operational site monitoring;**
    ii. **Emergency response for leakage of injectate into USDWs or at the surface.**
    iii. **Proposed corrective action for conduits within the AOR**
    iv. **Site closure Michigan (no, by rule)**
    v. **Post closure site monitoring**
c. **A map showing faults and direction of regional fracture patterns**
d. **A regional geologic stress analysis** **Michigan, Texas RRC**
e. **The location of every artificial penetration in the AOR (including wells, shafts, etc.)**
f. **The current BHP of the proposed injection zone** **Michigan (as needed)**
g. **A geochemical analysis of the proposed injection zone rock matrix**
h. **A hydrochemical analysis of the native fluid in the proposed injection zone**
i. **A structure map of the proposed injection and confining zones**
j. **Cross sections of the proposed injection and confining zones and USDWs within the AOR showing facies changes**
k. **A CBL/VDL for existing wells in the AOR that penetrate the proposed injection or confining zones**
l. **A well construction diagram of the proposed well including all casing string sizes, type s and depths, cement volumes, types and tests, packer types and setting depths, proposed perforation intervals and open hole intervals. Texas RRC: no diagram, but must provide this information.**
m. **The proposed average daily, monthly and annual injection volume**
n. **An chemical analysis of the injectate**
o. **A post construction CBL/VDL of the injection well**

p. **The results of a well MIT**
q. **Proof of ownership or leasing of the proposed injection zone within the boundary of the AOR. (Texas RRC: No. Operator must have the rights but no proof required.) Texas CEQ: no**
r. **Copies of any public notifications to landowners with a certain distance of the well or outer boundary of the AOR**
s. **Copies of plugging reports for plugged wells in the AOR Texas RRC: No, unless there is a question**
t. **A model of the calculated extent and location of the injection plume during the life of the project and post closure monitoring period.**
u. **Bonding or financial assurance for the project/well**
v. **Specifications of the surface facilities including the following: Michigan, Texas RRC; West Virginia (Class VI, agency will set standards of acceptability and the operator will have to meet the performance standard).**
    i. **Pumps**
    ii. **Piping**
    iii. **Gauges**
    iv. **Valves**
    v. **Automatic shutoff systems Texas RRC, proposed for Class VI**
    vi. **Tanks**
    vii. **Pits Texas RRC: yes through 16 TAC 3.8**
    viii. **Compressor stations**
    ix. **Fuel storage**
    x. **Chemical storage**
    xi. **Alarm systems**
    xii. **Emergency equipment**
    xiii. **Safety equipment**
    xiv. **Gas treatment equipment, etc…**
w. **MSDS for all chemicals used or stored on site Michigan IOSHA requires submission of MSDS. Texas acknowledges the Federal Law. West Virginia: Yes, probably assigned to Mining Division of DEP. Wyoming: No. Texas CEQ: No.**

Kansas KCC: Under current regulations, KCC requires (e), (l), (m), (p), (r), (s), (u), (v-vii), (w, in conjunction with KDHE). Under the new Class VI regulations, all categories <u>would be required</u> except (d), (h), (k), (v-I), (v-iii), (v-vi), (v-viii-v-x), (v-xii through V-xiv).

Mississippi O&GB: No, unless these items become a Federal requirement. They currently do a number of these to the extent required for the Class II program.

Mississippi DEQ: Same as O&GB except yes for (v.iii, similar to Class I), (v. v), (v.xi, alarm systems. DEQ RCRA program handles (w) MSDS sheets.

23. **Do you allow/require review of permit applications by other state agencies or divisions and do these entities have authority to stop a permit application? (Under what circumstances?)**

Kansas KCC: No review by other agencies either done as a general procedure or required to do so by law. KCC may give KDHE or Division of Water Resources notification of any UIC application for a well to be located an area where the latter agencies are conducting enforced groundwater remediation activities or impaired ground water investigations. Same procedure for CO_2 Class VI.

Michigan DNRE: For Class VI, will consult other agencies as needed. Not currently required for UIC.

Mississippi O&GB: No.

Mississippi DEQ: Permit from the O&GB required on all wells drilled below fresh water.

Texas CEQ: Required to furnish copies of submitted applications to specified agencies. There is no time limit for response. The response from the Texas Department of Health is advisory, however, an adverse reaction from the Texas Railroad Commission would stop the application (in all cases?).

Texas RRC: The applicant must submit a letter from the TCEQ or its successor agency stating that the use of the proposed formation for disposal will not endanger freshwater strata in that area and that formations to be used for disposal are not freshwater bearing. For Class II EOR wells, the applicant is required to identify the depth(s) of usable-water quality within the permit area, as determined by TCEQ. **For Class VI:** the Texas Water Code #27.046 requires that an applicant submit a letter from the Executive Director of TCEQ stating that drilling and operating an anthropogenic CO_2 injection well for storage or operating the geologic storage facility will not injure any freshwater strata in that area and that the formation or stratum to be used for the geologic storage facility is not a freshwater formation or stratum.

West Virginia DEP: No, but other agencies will get a copy of the permit as a courtesy if it is relevant to them.

Wyoming DEQ: Chapter 24, Section 19 requires that UIC draft permits be provided to certain agencies, for comment. Agencies have 30 days to comment and by agreement, EPA has 45 days. DEQ not required to implement comments but often honor them. The CO_2 Class VI regulations call for a 60-day comment period.

24. Do permit applications undergo reviews for any of the following:

a. Archeology
b. Endangered species
c. State owned land
d. Federally owned land (BLM, USFS, MMS, etc.)
e. Environmental coordination reviews with other agency permitting
f. Other associated reviews

Kansas KCC: No specifically to (a) through (e). Only for water use. Kansas has an Environmental Coordination Law which requires the Division of Water Resources (DWR); Board of Agriculture to give KCC and other agencies 30 days to comment on water use applications and to tell DWR if any water use permit would create an environmental conflict with one of their regulated activities (i.e., a location of a watershed in an area of a plugged well.)

Michigan DNRE: Yes to all but (a).

Mississippi O&GB: Yes for (c) and (d). State and federal owned lands. No to the rest.

Mississippi DEQ: No, to all categories.

Texas CEQ: No except for (c) for School Land Board land and (e) for some Class V permits and remediation projects.

Texas RRC: No except for (d) Environmental coordination reviews with other agencies.

West Virginia: Yes, to all categories. Send automatically to the WVA Highway Department.

Wyoming DEQ: Yes to all but (c), (e), and (f); Reviews on state owned lands.

25. Describe your permit transfer review process for UIC wells.

Kansas KCC: 83-3-1104 of the CO_2 regulations makes the transferring operator responsible for filing transfers at least 30 days prior to the transfer on KCC forms. The transferee shall demonstrate financial responsibility in a form approved by the Conservation Division. Process similar to what is required for Class II. Landowner notification of pending transfer is required.

Michigan DNRE: Currently for Class II, transferor responsible for initiating notification of transfer with DNRE. Transferee cannot operate or produce until the owner or representative of the owner demonstrates that the well or facility is in compliance.

Mississippi O&GB: New operator must file a Form 2 for change of operator with signatures of old and new operator accompanied by a $100 check and bond or letter of credit in the amount of $20,000 per well or $100,000 blanket bond.

Mississippi DEQ: Determined by Federal regulation by reference.

Texas CEQ: Transferring entity pays a $100 for transfer to a new operator (Class I). Treated as a permit amendment. Agency requires financial assurance of the transferee, does a compliance review, but no technical review.

Texas RRC: Describe your permit transfer review process for UIC wells. None for Class II and Class III. Proposed Chapter 5 for Class VI wells**(c) Permit transfer**. An operator may transfer its GS facility permit to another operator if the requirements of this subsection are met. A new operator may not begin operating the GS facility without a valid permit. (1) Notice. An applicant must submit written notice of an intended permit transfer to the director at least 60 days prior to the date the transfer is proposed to take place.
The applicant's notice to the director must contain all of the following:
(i) the name and address of the person to whom the GS facility will be sold, assigned, transferred, leased, conveyed, exchanged, or otherwise disposed;
(ii) the name and location of the GS facility and a legal description of the land upon which the storage facility is situated;
(iii) the date that the sale, assignment, transfer, lease conveyance, exchange, or other disposition is proposed to become final; and
(iv) the date that the transferring operator will relinquish possession as a result of the sale, assignment, transfer, lease conveyance, exchange, or other disposition.

(B) The person acquiring a GS facility, whether by purchase, transfer, assignment, lease, conveyance, exchange, or other disposition, must notify the director in writing of the acquisition as soon as it is reasonably possible but not later than the date that the acquisition of the GS facility becomes final. The director may not approve the transfer of a GS facility permit until the new operator provides all of the following:
–the name and address of the operator from which the GS facility was acquired;
–the name and location of the GS facility and a description of the land upon which the GS facility is situated;
–the date that the acquisition became or will become final;
–the date that possession was or will be acquired; and
–the financial assurance required by this subchapter.
(2) Evidence of financial responsibility. The operator acquiring the permit must provide the director with evidence of financial responsibility satisfactory to the director in accordance with §5.205 (Fees and Financial Assurance).
(3) Transfer of responsibility. An operator remains responsible for the GS facility until the director

approves in writing the sale, assignment, transfer, lease, conveyance, exchange, or other disposition and the person acquiring the storage facility complies with all applicable requirements.

West Virginia DEP: Current permittee must submit documents on sale, deed and financial responsibility. A fee is involved.

Wyoming DEQ: Permit transfer process for Class VI will be identically to that currently required for Class I. Proposed Chapter 24; Section 4 (b) paragraph (xv).

26. Describe your bonding/financial assurance system relative to the following:

a. What types of bonds does your agency accept? (e.g., CD, cash, surety, letters of credit)

Kansas KCC: Bonding is on the license of the operator, not the wells. All operators, and other persons engaged in well construction and plugging must be licensed.

Michigan DNRE: All of these and also a statement of financial responsibility.

Mississippi O&GB: Surety bond or irrevocable letter of credit.

Mississippi DEQ: Letter of credit.

Texas RRC: The Commission accepts financial security in the form of an individual performance bond, blanket performance bond, letter of credit, or cash deposit filed with the Commission. The Commission will also accept a well plugging insurance policy.

Texas CEQ: Trust funds (may be funded by CDs or cash), surety bonds, letters of credit.

West Virginia DEP: No bonding on Class V wells. Bonding for Class VI will be decided by Committee.

Wyoming DEQ: All the listed are accepted currently, but for Class VI these allowances are unknown. New regulations will be developed to specify the types and amounts of financial assurance required.

b. Do you allow blanket bonds?

Kansas KCC: Yes, according to the number of wells. No bonding is required after three years of good behavior (performance). In the Class VI regulations, the 5 cent/ton of injected CO_2 would cover plugging.

Michigan DNRE: Yes, for Class II wells.

Mississippi O&GB and DEQ: Yes, however DEQ redoes the cost estimate every 5–10 years.

Texas CEQ: No, do not recognize the term.

Texas RRC: Yes.

Wyoming DEQ: No, do not recognize the term.

c. Do you utilize a bond pool or other shared risk system for financial assurance?

Kansas KCC: There is a well assurance fund for wells drilled after 1996 for plugging orphan wells. This is funded by annual operator's license fee. Most funding comes from a combination of operator assessment on production and state water plan development money.

Michigan DNRE: No.

Mississippi O&GB and DEQ: No.

Texas CEQ: No, TCEQ does not use a bond pool or other shared risk system for financial assurance.

Texas RRC: Yes.

Wyoming DEQ: No.

d. Are your bonds performance bonds or penal bonds?

Kansas KCC: Performance.

Michigan DNRE: Performance (not full cost).

Mississippi O&GB and DEQ: Performance.

Texas CEQ: They are performance bonds; the surety provider either provides the funds for the state's use in plugging a well or may opt to hire its own contractors to plug the well.

Texas RRC: Performance.

Wyoming DEQ: Performance (full cost with periodic review of bonding amounts when permit is up for renewal). Similar reviews will be done for Class VI.

e. When are bonds released? (after plugging, site cleanup, etc.)

Kansas KCC: Not released until district staff is satisfied site is cleaned up.

Michigan DNRE: After site restoration.

Mississippi O&GB: Upon operator request following site restoration, upon change of operator, and NORM survey.

Mississippi DEQ: Same without the NORM survey.

Texas CEQ: Bonds are released after the well is plugged.

Texas RRC: (After plugging, site cleanup etc.) Persons performing oil and gas operations within the jurisdiction of the Railroad Commission of Texas are required to execute and file with the Commission a bond covering those operations, pursuant to §91.103 and §91.104 of the Texas Natural Resources Code. The bond must be renewed and continued in effect until the conditions of the bond have been met or its release is authorized by the Commission or its delegate. Conditions of the bond are met when the operator is in compliance with state law and Commission rules, orders, and permits requiring operators to plug and abandon all wells and control, abate, and clean up pollution associated with an operator's oil and gas operations and activities.

Wyoming DEQ: After wells are plugged and abandoned.

27. Do you have authority to require an applicant to prove they have an appropriate property right prior to issue a permit? (e.g., lease or ownership documents)

Kansas KCC: Yes, for Class VI CO_2 regulations. Statement of legal right to put CO_2 underground.

Michigan DNRE: No documentation currently required. State is considering condemnation process for CO_2 projects.

Mississippi O&GB: No.

Mississippi DEQ: Yes, for surface and mineral ownership.

Texas CEQ: No, but an application must contain a list with a map showing all land and mineral owners on or adjacent to the well. Permit does not convey a property right.

Texas RRC: No. The applicant must have the rights to drill and operate an injection well, but RRC staff does not verify.

West Virginia DEP: Yes. Demonstration of property right.

Wyoming DEQ: State has decided that permit will contain a disclaimer that the permit does not convey a property right.

28. Will you track and monitor CO_2 injection for the purpose of awarding carbon credits? If not your agency, which state agency will do this?

Kansas KCC: No.

Michigan DNRE: Will be done in another division of DNRE; if at all.

Mississippi O&GB and DEQ: Both indicated state tracking by them was possible.

Texas CEQ: No, but proposals were made in legislation to define clean energy projects with tax rate reductions etc. Proposed to be administered by the state comptroller's office but TCEQ and TRRC may need to verify.

Texas RRC: Several state statutes allow for severance tax credits on oil/gas for anthropogenic CO_2 that is sequestered. RRC is tasked with tracking the amount of CO_2 sequestered for this purpose.

West Virginia DEP: Committee will decide if done and where. Might be DEP or some other entity.

Wyoming DEQ: Awaiting congressional or EPA action on carbon credits. Suspect Air quality would manage.

29. Will you regulate air emissions from geosequestration operations? If not your agency, which state agency will do this?

Kansas KCC: Kansas Dept. of Health and Environment (KDHE).

Michigan DNRE: Likely the Air Quality Division.

Mississippi O&GB: No.

Mississippi DEQ: Yes.

Texas CEQ: Probably TCEQ Air Quality Division (Office of Air Quality).

Texas RRC: TCEQ will regulate air emissions from geosequestration operations for the purpose of air pollution. TRRC will monitor a GS facility to ensure that the CO_2 is sequestered.

West Virginia DEP: Yes, in consultation with the DEP Air Quality Division. Corrective action would require a cooperative effort between divisions.

Wyoming DEQ: Will likely be regulated by the Wyoming DEQ Air Quality Division.

30. Do you currently require the installation, use and reporting of monitoring wells in the AOR of UIC wells (which classes)?

Kansas KCC: Currently done only in some Class II remediation sites. Is provided for in Class VI.

Michigan DNRE: No, but probably will under Class VI CO_2.

Mississippi O&GB: No.

Mississippi DEQ: Yes, with quarterly reporting of analysis from wells plus monitoring of Public Water Supply (PWS) wells.

Texas CEQ: No for current Class I but probably for Class VI. They do extensive monitoring on Class III.

Texas RRC: Yes, currently for Class III and proposed for Class VI.

West Virginia DEP: Yes, based on facility circumstances on a case-by-case basis.

Wyoming DEQ: On a case-by-case basis. For example, Class VI wells will likely require monitoring wells.

31. Do you currently conduct any soil or air monitoring related to UIC permits?

Kansas KCC: No, but Class VI authority provides for soil monitoring. Air would be the responsibility of KDHE Bureau of Air Quality.

Michigan DNRE: No except for spills.

Mississippi O&GB: No.

Mississippi DEQ: Yes, for Class V experimental CO_2 well.

Texas CEQ: No. May be considered in rules at the Director's discretion but may not be routine.

Texas RRC: No.

West Virginia DEP: Only as needed but not a requirement.

Wyoming DEQ: Not currently. Authority exists for Class VI but decisions will be made on a case-by-case basis.

32. Approximately how many enforcement actions (Informal and formal) have you taken annually over the past 3 years for UIC activities?

Kansas KCC: 2007—5,100 (mostly administrative); 2008—721; 2009—1,300.

Michigan DNRE: Estimated 10 per year. Mostly notices of non-compliance for not operating well properly.

Mississippi O&GB: None.

Mississippi DEQ: None.

Texas CEQ: 2006—11 informal; 2 formal; 2007—16 informal; I formal; 2008—11 informal; 2 formal and 2009—17 informal; 1 formal.

Texas RRC: 2007; 49 final enforcement orders; 2008 and 2009; 65 final enforcement orders for each year, Total enforcement actions, 1947.

West Virginia DEP: 378 total enforcement actions for 2007–2009.

Wyoming DEQ: 25–30 informal per year; 5 formal; Orders come out of the Dept.

33. Do you have civil penalty authority?

Kansas KCC: No. KCC is a judicial body with penalty levying authority whose decisions are *res judicata*. Appeal is made to the District Court.

Michigan DNRE: Has to resort to court action to issue fines. Cases filed in the county where the violation occurred.

Mississippi O&GB: Yes, for violations if a show cause is issued due to failure to correct a violation (up to $10,000 for day of violation.

Mississippi DEQ: Yes, through a written procedure with different valuations (or amounts?) of fines.

Texas CEQ: Yes.

Texas RRC: Yes.

West Virginia DEP: DEP's Environmental Enforcement Division has authority.

Wyoming DEQ: Yes. Under 35-11-901. Statutes use the standard monetary penalty plus a potential jail sentence for each day of violation.

34. Do you have criminal penalty authority or can you refer enforcement cases for criminal prosecution?

Kansas KCC: No. Commission rulings are *res judicata*. Aggrieved party can file an appeal through the state appellate court system. The Attorney General can file additional criminal charges.

Michigan DNRE: DNRE is required to pursue criminal proceedings through local, county, or Attorney General for action.

Mississippi O&GB: Cases taken to the State Attorney for further action. This is done through the attorney assigned to the Board.

Mississippi DEQ: Yes, through the agency's legal Division. Some cases would be referred to the Mississippi Dept. of Justice.

Texas CEQ: Yes.

Texas RRC: No.

West Virginia DEP: Yes; handled by the Environmental Enforcement Division.

Wyoming DEQ: Yes, through the AG's office. Ability to fine $25,000 per day per violation.

35. Do you have pipeline severance authority?

Kansas KCC: Commission has authority to issue orders to shut in wells. Suspension of Operator's license effectively shuts down all E&P activity until violations are corrected.

Michigan DNRE: Prohibition to gatherers to prevent purchase of oil/gas.

Mississippi O&GB and DEQ: No.

Texas CEQ: TCEQ can get a pipeline shut in by obtaining a court order/injunction. Also, in an emergency response situation involving a pipeline, TCEQ field staff coordinate with local emergency response programs to address any needed shut in of pipelines.

Texas RRC: Yes.

West Virginia DEP: No.

Wyoming DEQ: N/A, but may rest with an independent commission where authority to take such action is not under the Federal Pipeline Authority.

36. Do you have the authority to revoke permits for enforcement, bonding or other reasons? (Please explain)

Kansas KCC: Failure to maintain licensing or suspension of a license can lead to shut down of operator's E&P activities statewide. Commission can also revoke a permit and then reinstate a permit after the problem has been corrected.

Michigan DNRE: Permits can be suspended but not revoked. DNRE feels it loses control of the operator when a permit is revoked.

Mississippi O&GB: Yes (Non-compliance with enforcement orders, bonding violations or other violations of Rule 63.

Mississippi DEQ: Yes, through Commission on Environmental Quality action (governor's appointees).

Texas CEQ: Yes, but only by Commission vote.

Texas RRC: Yes.

West Virginia DEP: Yes. No bonds to revoke for Class V.

Wyoming DEQ: Yes. Procedure spelled out in proposed Chapter 24, Section 4, paragraph b, Sub VIII.

37. If a permit is revoked and/or a bond forfeited and state remediates or closes a site can you still seek full restitution from the permittee for the costs?

Kansas KCC: Yes.

Michigan DNRE: Yes.

Mississippi O&GB: No.

Mississippi DEQ: Yes, if situation is declared an emergency.

Texas CEQ: In matters of hazardous substance remediation, TCEQ participates with EPA in CERCLA/Superfund cleanup to address problems which may be discovered after permits and financial assurance are no longer in effect. Under this program, the state would seek restitution from responsible parties. A similar ability exists under the Texas Radiation Control Act for radioactive materials.

Texas RRC: Yes.

West Virginia DEP: No.

Wyoming DEQ: No, but can refer to the Attorney General's office for legal action.

38. Please describe which of the following types of information is stored in electronic form:

a. Permit applications
b. Well location data
c. File review data

d. **Well completion reports**
e. **Injection reports**
f. **Inspection reports**
g. **Well plugging reports**
h. **Enforcement documents**
i. **Lease or ownership documents**
j. **Bonding or financial assurance documents**
k. **Injectate analysis reports**
l. **USDW analysis reports**
m. **Permit transfer/ownership data**
n. **Surface facilities data**

Kansas KCC: Yes for (b), (d), (e), (g), (j), (m). No for (a), (f, in planning), (h, in planning) (i), (k, probably for Class VI), (l), (n, some for Class VI). (c) Some.

Michigan DNRE: Yes to all except (e) injection reports (DI program); (i) lease or ownership documents and (l) only if submitted with application.

Mississippi O&GB: Yes to complete list.

Mississippi DEQ: No to entire list.

Texas CEQ: No to all but (b), (f) findings only, (m) and (n).

Texas RRC: Yes to all except (i), (j) (k), (l), and (n) except for permitted pits.

West Virginia DEP: Yes to entire list.

Wyoming DEQ: Yes to all but (i) and (j).

39. **Do you have GIS capability? (Please describe.)**

Kansas KCC: Limited to some access to ArcView® in the KCC Utilities Div. And certain access through the Univ. of Kansas. Will have for Class VI if funding available.

Michigan DNRE: Yes and No. Have ArcView® for well locations but not other information.

Mississippi O&GB and DEQ: Both have Arc®.

Texas CEQ: Yes; have Arc® software.

Texas RRC: Yes; did not describe but probably Arc®.

West Virginia DEP; Yes; Arc®.

Wyoming DEQ: Yes, ArcInfo® for Class I.

40. **Does your field staff have access to your electronic data via laptops or PDAs?**

Kansas KCC: Laptops with internet connectivity (IC) through RBDMS; Air cards, One District Office (Hays) does not have IC.

Michigan DNRE: Yes (field access to central data in pilot phase). Record sets in GPS, air card.

Mississippi O&GB: Yes to everything via laptop.

Mississippi DEQ: No.

Texas CEQ: No, not routinely.

Texas RRC: Yes.

West Virginia DEP: Not available to field staff.

Wyoming DEQ: Yes.

41. Does your field staff have GPS data capture capability?

Kansas KCC: Yes.

Michigan DNRE: Yes.

Mississippi O&GB & DEQ: Yes.

Texas CEQ: Yes, handheld GPS.

Texas RRC: Yes.

West Virginia DEP: Yes.

Wyoming DEQ: Yes.

42. Do you utilize BMPs, field manuals or other guidance documents to implement your program? (Please describe.)

Kansas KCC: No for current Class II UIC program. Would probably develop instructional materials or manuals for Class VI.

Michigan DNRE: Not really, but occasionally have prepared rule interpretation materials.

Mississippi O&GB: Strictly follow the rules but no special interpretative documents.

Mississippi DEQ: Written procedures (e.g., MITs, EPA Inspector Training).

Texas CEQ: Yes (technical manuals, text books EPA publications and manuals from other sources). Application forms also have guidance for Class I, III, V.

Texas RRC: Yes. Injection/Disposal Well Permit Testing and Monitoring Seminar Manual. Accessible through http://www.rrc.state.tx.us/forms/publications/HTML/index.php.

West Virginia DEP: None presently, however a guidance document will be developed for industry for Class VI C CO_2.

Wyoming DEQ: Does have guidance documents (content for regulated entities).

43. Do you or can you require permittees to retain records for a specified period of time? (How long?)

Kansas KCC: Class II is currently 5 years and newly promulgated Class VI is the same.

Michigan DNRE: No set requirement. Agency keeps records into perpetuity.

Mississippi O&GB: No operator requirement, agency has records.

Mississippi DEQ: Keeps information but uncertain about time length. (will check on)

Texas CEQ: For Class I injection wells , records must be retained by the operator for three years after well closure (plugging). The TCEQ UIC program retains well records for thirty years after well closure.

Texas RRC: Yes. Class II—All monitoring records shall be retained by the operator for at least five years. Other records must be retained for a minimum of three years.

West Virginia DEP: Yes, for a minimum of five years.

Wyoming DEQ: Three years following abandonment.

44. Do you allow the submission of reports as confidential business information? (Please describe which records, how long, exceptions, etc.)

Kansas KCC: Yes, one year for completion information on new wells, with additional years up to three upon written request by the operator. Probably would be less flexible for Class VI.

Michigan DNRE: Exploratory holes can get a 90-day confidentiality stay with no extension. Determined on a case-by-case basis.

Mississippi O&GB: Operators may request confidentiality for logs for six months with extensions available upon request; anything before Board until Board rules.

Mississippi DEQ: Yes, for waste reduction reports, seismic data, financial reports (indefinite), trade secret information.

Texas CEQ: Legal Department determines confidentiality request approval on a case-by-case basis. There is generally no time limit once confidentiality is approved.

Texas RRC: Yes. Well logs, however, if a log is submitted as a part of an application it becomes a part of the public record.

West Virginia DEP: None currently for Class V. None planned for Class VI. Draft reports are not official for release.

Wyoming DEQ: Uses statute 35-11-1101 for retention of confidentiality of trade secrets. Dept. would decide well info confidentiality on a case-by-case basis.

45. Do you have the capability to receive permit applications, reports, and other data electronically? Please describe your system.

Kansas KCC: Yes.

Michigan DNRE: Working on electronic submittal of permit applications. Production information sent in electronically.

Mississippi O&GB: Yes, but require a follow-up hard copy No determination on compliance with the Cross Media Electronic Reporting Rule (CROMERR).

Mississippi DEQ: Yes to capability but a follow-up hard copy is required.

Texas CEQ: No! Because of CROMERR!

Texas RCC: Annual monitoring reports may be filed online.

West Virginia DEP: Yes. Have electronic submission guidelines. Not sure about compliance with CROMERR.

Wyoming DEQ: Yes, Internet based; still require hard copy as long as CROMERR is around.