C O M M E N T

Long-Term Stewardship of Geologic Sequestration of CO₂

by John Pendergrass

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avid Adelman and Ian Duncan propose to combine liability with regulation of geologic sequestration of CO₂,¹ providing a useful discussion of the relative advantages and disadvantages of each policy instrument as applied to carbon capture and sequestration (CCS). Further details of how their proposal would be implemented are essential to fully evaluating its merits and likelihood of success. The authors make a valuable contribution to interdisciplinary understanding of the technical and legal issues associated with geologic sequestration of carbon dioxide (CO₂) by reviewing and explaining the scientific literature of sequestration preliminary to concluding that risks associated with the technology are misunderstood. They suggest that the risk of release of CO_2 is likely to have a longer latency period than advocates of carbon capture and sequestration assert, but that such releases of CO₂ to the atmosphere will not pose a significant threat to humans.² According to the authors, the most significant harm to the environment will be contamination of drinking water due to brine intrusion.

Through their extensive discussion of the low risks of CO_2 leakage the authors seem to suggest that there is little need to design a system to prevent or govern releases of CO_2 into the atmosphere. The authors and the IPCC Special Report discuss the technology of CCS in terms of its likelihood of containing the injected CO_2 in the geologic formations and minimizing the potential for releasing CO_2 . Both the authors and the IPCC also assert that monitoring and detection technologies are likely to discover such releases in a relatively short time after the release begins or even before it reaches the surface. These may indeed be unlikely events, but experience in other fields suggests that uncertainty is a given and that technology and human endeavors do not always operate as expected or intended.

The technology for CCS has the potential to sequester a large percentage of CO_2 emissions over the next few decades. In part this is due to the large number of sites that are asserted to be suitable for CCS. The combination of the large number of sites and quantity of CO_2 sequestered with the long time periods essential to making CCS viable increases the significance of the effects that even a low probability event might have. The system for governing this technology should be designed to deal with these risks.

Latency is the key issue for governing CCS, which the authors note is the "Achilles heel of tort liability."3 Having explained why liability is inadequate to promote good decision making in site selection and operation, the authors assert that "government regulation has the capacity to target risks with long latency periods."4 The focus on design of a regulatory system is too narrow. Implementation of regulations is as important to the success of a regulatory system as the drafting of the regulations. Assuming that it is possible to pass legislation to authorize an appropriate regulatory system,⁵ drafting "effective performancebased regulations" is a difficult and uncertain task, but it is at least a discrete and likely a one-time task. Assuming further that such regulations are promulgated, implementation will be critical. The decades over which it will be necessary to implement these regulations is when the "temporal myopia and political pressures" are more likely to manifest and be more debilitating than during promulgation of regulations. The regulatory aspect of the preferred hybrid system can be successful only if it is implemented consistently over the required decades by a large number of actors.

The Safe Drinking Water Act, like most federal pollution control statutes, is delegable to the states. State implementation of federal minimum standards under federal environmental statutes is a significant strength of the federal system, but it also is much more complicated than

David E. Adelman & Ian J. Duncan, The Limits of Liability in Promoting Safe Geologic Sequestration of CO., 22 DUKE ENVIL. L. & POL'Y F. 1 (2011).

^{2.} Id. at 2. But see INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, SPE-CIAL REPORT ON CARBON DIOXIDE CAPTURE AND STORAGE 34 (listing several potential human exposure pathways and risks to human health and life).

^{3.} Adelman and Duncan, *supra* note 1, at 6.

^{4.} *Id.*

^{5.} Id. at 10-11 (EPA authority under the Safe Drinking Water Act is limited to setting minimum standards and additional authority would be required to authorize a program to rank sites and to establish liability for releases of brine). Legislation would also be required to provide for government assumption of long-term stewardship.

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the system as laid out by the authors. Delegation to states mitigates some of the difficulties raised by the authors, particularly the assumed lack of capacity of EPA staff to monitor site operations. By assuming responsibility for implementing federal statutes, states substantially amplify the number of staff available to implement those laws. As much as 90 percent of enforcement of federal environmental laws is by state officials. But such delegation also makes it more difficult to achieve consistent implementation of the minimum federal standards for site selection and operation. Monitoring and enforcement by states also varies substantially, both among states and over time within a particular state. Federal oversight is an imperfect means for assuring consistent implementation of federal laws and is a nearly constant source of tension between states and the federal government. This is the reality that must be considered in determining what approach to coping with risk is most appropriate—not just what are the best instruments in theory, but what can be implemented under the existing system.

In particular, increased attention is needed to long-term stewardship of CCS "sites" after the post-closure period of responsibility that EPA guidance suggests is appropriate. The authors devote relatively little attention to this aspect of long-term stewardship, asserting that there is consensus in favor of government assumption of this responsibility, but acknowledging controversy exists over how this should be accomplished.⁶ Experience with contaminated sites, buried pipelines and electric lines, and storage of nuclear waste, among other long-lasting underground risks demonstrates that long-term stewardship is a complex undertaking.⁷ The lessons learned from these programs indicate that long-term stewardship deserves the same attention to its design and implementation as does the regulatory system for CCS.

Long-term stewardship encompasses all activities required to maintain an adequate level of protection to human health and the environment from the hazards posed by a particular activity, in this case CCS.⁸ In order to be effective, long-term stewardship must meet objectives based on the risks against which it is intended to provide protection.⁹ In the case of CCS, it would need to operate for as long as the risk remains, or approximately 100 years for the risk of brine intrusion. It would need to minimize human and environmental exposure; provide information to future users of the CCS field and potentially affected aquifers of the risks associated with activities that might increase the risk of brine intrusion; maintain records and information about the CCS field and its potential effects on surrounding resources in a manner that will allow future regulators and users to reevaluate the risk to determine if different measures are needed (or the existing ones may be relaxed); and be effective even if future users ignore or are not aware of the available information.¹⁰

It is too simple to say that long-term stewardship of CCS sites should be the responsibility of the federal government. First, that ignores that the federal government has generally asserted that it should not be responsible for long-term stewardship of contaminated sites, unless it owned the land or was responsible for the contamination. In the case of contaminated sites, the federal government prefers that owners and operators of sites be responsible for long-term stewardship with states assuming primary responsibility for oversight. The Waste Isolation Pilot Project and the federal responsibility for a disposal facility for waste nuclear fuel are exceptions based on statutory requirements passed to facilitate development of civilian nuclear power. Similar legislation would be necessary to establish federal government responsibility for CCS sites.

Long-term stewardship implicates too many entities and levels of government for it to be fully assigned to the federal government, or to any single entity. CCS will affect such large areas and in such different manners that it is misleading to refer to a CCS "site". There is the limited area covered by the borehole, the larger underground area where CO₂ is injected and eventually will migrate to fill, and there is the even larger area subject to increased pressures. Each of these presents different functions for monitoring, recordkeeping, and providing warnings to potential users of those spaces. Information about the CO₂ field will need to be provided to anyone who might consider drilling in those areas. Precedents for such systems exist in the "Miss Utility" programs warning people to check for buried utilities before they dig. But, such programs regularly and consistently fail, though those failures relatively rarely result in injury or death.¹¹ These systems are mandated by federal rules, but implemented by the states and private parties.

Similarly, long-term stewardship to protect against intrusion of brine into drinking water supplies will necessarily involve the public and private suppliers who use potentially affected aquifers as well as the states that regulate such suppliers. In many parts of the country the potential users of such aquifers will include homeowners, some of whom can be expected to drill without first consulting any authority. Moreover, in some states property owners will have the right to drill to obtain water for individual use. It is highly unlikely that any federal legislation on CCS will attempt to preempt state laws relating to regulation of groundwater.

Long-term stewardship of CCS will require a spectrum of activities from setting performance standards, to keeping records of injection sites, to monitoring pressures and movement of CO_2 and brine plumes, to provision of information to property owners and users, water suppliers, drillers, and others. Those activities cannot, and should not, all

^{6.} Id. at 5.

^{7.} See Environmental Law Institute, Institutional Controls in Use (1995).

^{8.} *See, e.g.*, Environmental Law Institute and Energy Communities Alliance, The Role of Local Governments in Long-Term Stewardship at DOE Facilities (2001).

See John Pendergrass, Institutional Controls in the States: What Is and Can Be Done to Protect Public Health at Brownfields, 35 CONN. L. REV. 1303, 1313 (2003).

^{10.} Id. at 1313-14.

^{11.} INSTITUTIONAL CONTROLS IN USE, *supra* note 7.

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be undertaken by a single entity. Adelman and Duncan note that most proposals for long-term stewardship of CCS are multilayered, which is appropriate given the nature of the activities involved and the variety of people and entities affected by those activities. To be effective long-term stewardship must be multilayered because experience has shown that no single measure is sufficient to protect against risks that have long latency periods and are not easily observed.