Appearing before the Subcommittee on Energy and Environment
Committee on Science and Technology
U.S. House of Representatives

Testimony on Prospects for Advanced Coal Technologies and Geological Carbon Sequestration

Robert J. Finley
Director, Energy and Earth Resources Center
Illinois State Geological Survey
finley@isgs.uiuc.edu

May 15, 2007

Understanding the capacity to geologically sequester carbon dioxide (CO_2) as a byproduct of fossil fuel use, including the use of advanced coal technologies, is an essential strategy to mitigate the growing potential for climate change related to carbon dioxide buildup in the atmosphere. At the Illinois State Geological Survey, we have been investigating this capacity for more than five years, and, since October of 2003, have been doing so as part of a U.S. Department of Energy (DOE) Regional Carbon Sequestration Partnership. This Partnership covers the Illinois Basin, a geological feature that extends across most of Illinois, southwestern Indiana, and western Kentucky. Our sister geological surveys in Indiana and Kentucky are our partners in this research. Our Phase I effort focused on compiling and evaluating existing data and resulted in a 496-page report in December 2005 indicating 1) that suitable CO_2 sequestration reservoirs were present in the Illinois Basin, and that 2) sufficient sequestration capacity existed warranting further investigation. We then entered a Phase II validation effort, in which we are currently engaged, in which six small-scale, field pilot injection projects will be carried out through September 2009. The injection phase of one field pilot has been completed and two more will see either injection or drilling of new wells for injection within the next 90 days. While planning and executing these field pilot projects, we have also been making further detailed assessments of geological storage capacity, as have the other six partnerships.

In July 2006, DOE managers for the Regional Carbon Sequestration Partnerships convened a meeting at the Kansas Geological Survey to begin the process of developing a

Carbon Sequestration Atlas of the United States and Canada. This Atlas was released in digital form in March 2007 and the first edition of the printed version was released last week in Pittsburgh at DOE's annual carbon capture and sequestration conference. The Atlas was developed on the basis of regional partnership work that began in 2003, and earlier, to understand the major geological reservoirs that may be utilized for carbon sequestration. This Atlas also builds on the work supported by DOE in the form of the original MIDCARB, and now NATCARB, digital databases that are accessible on the Internet. The Atlas documented some 3,500 billion tons of storage capacity in the regions covered by the Partnerships. In my judgment there is sufficient geological carbon sequestration capacity in the United States for geological sequestration to be one of multiple tools useful on a large scale to reduce CO_2 emissions from fixed sources such as coal gasification facilities. In the Illinois Basin region, if we could capture 80 percent of all current fixed-source emissions, a volume of 237 million tons of CO_2 per year, we would have storage capacity for 122 to 485 years of emissions just in the deep saline reservoirs.

While compiling our Phase I report, and while setting up environmental monitoring programs integral to each of our six field pilot projects, we have been aware of the need to understand the risks, both short and long term, of geological carbon sequestration. We have been paying as much attention to the overlying rock that will hold the carbon dioxide in place, the reservoir seal or caprock, as we have to the qualities of the reservoir rock that the CO_2 will be injected into. To be an effective climate change mitigation strategy, the CO_2 must remain in place and not leak back to the atmosphere, not contaminate potable ground water, not affect surface biota, and not present a risk to human health and safety. That implies that we must do an excellent job of investigating the properties of these rocks and the fluids now within them and predicting their performance in the future. We know that rock formations can perform as effective reservoirs and seals because they have trapped and held the oil and natural gas that we drill for and produce every day. These hydrocarbons have been trapped in place for millions to hundreds of millions of years before being brought to the surface through wells. To minimize the risk in CO_2 *injection*, the reverse of the oil or natural gas *production* process, we need to apply many of the same advanced methods as we use to find oil and natural gas. We need to evaluate subsurface rock formations to find thick and competent reservoir seals, to avoid areas where faults and fractures could become leakage pathways, and to understand the chemical changes in the pore space of the rock that the CO_2 will be injected into. All of this can be done to mitigate risk and if done well, and in sufficient detail, will allow appropriate sites with minimum risk to be selected for geological sequestration. After all, we also have decades of experience with underground natural gas storage projects at sites where tens of billions of cubic feet of flammable natural gas are stored safely and effectively.

With respect to the safety of established projects, we have been injecting CO_2 for enhanced oil recovery in West Texas for more than two decades. Since 1983, more than 600 million tons of pressurized CO_2 have been injected and 30 million tons are currently being injected annually in West Texas oil reservoirs. The safety record of this process has been excellent with not a single incident of loss of life. The injection of CO_2 for sequestration beneath the seabed of the North Sea has been taking place since 1996, and based on published reports, the CO_2 has been readily tracked in the subsurface using geophysical techniques and the process has been safe and effective. About 1 million metric tonnes per year are being injected at a sub-seabed depth of 3,300 feet under a caprock about 260 feet thick, comparable to shale caprocks in the Illinois Basin. I would conclude from this experience with CO_2, and from industry experience with geological storage of natural gas, that we should proceed with large-scale (1 million tons/year to 1 million tons over 3-4 years) tests of geological carbon sequestration for further evaluation of reservoirs and caprocks as they vary in different regions of the country. These projects need to be well funded and designed to build on the technical experience I have just described.

To establish public confidence, all the regional partnerships have been carrying out public outreach activities and have been integrating environmental monitoring into their small-scale field testing of CO_2 injection during Phase II. For our Illinois Basin region, this monitoring has been the largest single budget item in our Phase II project, and appropriately so. As we move to the upcoming larger-scale tests, we need to invest even more into education, outreach, and, especially, environmental monitoring to ensure public confidence. Our experience to date, very much informed by the public meetings we have held with regard to the two FutureGen finalist sites in Illinois, has been that openness and transparency are essential to the process of gaining public trust. Yes, we are putting something new into the subsurface. Yes, there are small and difficult-to-quantify risks, such as slow leakage, involved in carrying out any such effort. But, yes, we are working diligently and in the most open way possible to investigate the geology of sequestration, and I believe that the geologic framework has the capacity and the security that we require to make sequestration a viable carbon management strategy. I also believe, however, that some budget figures that I have seen for FY08 and FY09 are inadequate to fully execute and monitor these critical large-scale tests in diverse geological settings around the U.S. I trust that this Subcommittee and the full Committee on Science and Technology will have the opportunity to review those allocations and give priority to the Phase III Regional Partnership Program's large-scale testing, among other important sequestration programs that benefit from the investments made to date in technology and expertise by the Department of Energy.

In summary, I would suggest to the Subcommittee that we are beginning to have a substantive understanding of the geological capacity for carbon sequestration, especially based on research over the last two to five years in the U.S. and internationally. Advanced coal technologies including coal gasification for electricity production, coal to synthetic natural gas, and coal to liquid fuels will depend on geological sequestration capacity to directly manage their CO_2 emissions. The need for such management has been made all the more evident by the growing concern over climate change as embodied in the assessments released by the Intergovernmental Panel on Climate Change (IPCC) and other groups since February of this year. While we are advancing sequestration technology, we must also address issues of long-term liability for sequestration projects, legal access to subsurface pore space, and issues of who will bear the costs of sequestration and how those costs will be distributed. Some of these issues are beginning to be articulated, but it is unlikely that these issues, or the testing of advanced coal technologies combined with carbon sequestration, can be addressed without unprecedented public-private collaboration. I urge this Subcommittee to facilitate that process as we look forward to implementing advanced coal technologies incorporating geological carbon sequestration as a preferred and routine approach to coal utilization.

Robert J. Finley
Biographical Summary

Robert J. Finley is the Director of the Energy and Earth Resources Center at the Illinois State Geological Survey, Champaign, Illinois. He joined the Illinois Survey in February 2000 after serving as Associate Director at the Bureau of Economic Geology, The University of Texas at Austin. Rob's area of specialization is fossil energy resources. His work has ranged from large-scale resource assessment, addressing hydrocarbon resources at national and state scales, to evaluation of specific fields and reservoirs for coal, oil, and natural gas. He is currently heading a regional carbon sequestration partnership in the Illinois Basin aimed at addressing concerns with geological carbon management. Rob has served on committees of the National Petroleum Council, the American Association of Petroleum Geologists, the National Research Council, the Stanford Energy Modeling Forum, and the U.S. Potential Gas Committee. He has taught aspects of energy resource development since 1986 to numerous clients domestically and overseas in Venezuela, Brazil, South Africa, and Australia, among other countries. Rob holds a Ph.D. in geology from the University of South Carolina; he is currently also an Adjunct Professor in the Department of Geology, University of Illinois at Urbana-Champaign.