CO2 Sequestration in Sedimentary Basins: Major Remaining Issues

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Sequestration of CO2 in geological formations is a critical technology for reducing emissions of greenhouse gases over the coming century—and the only technology currently available for directly reducing emissions from large stationary sources of CO2. This will be particularly important for regions relying heavily on coal and natural gas for manufacturing and electricity production. Four industrial-scale sequestration projects, each sequestering from about 1 million tonnes per year, are now underway with cumulative sequestration adding to more than 25 million tonnes (Mt) of CO2. Geophysical, hydrological and geochemical monitoring has provided confidence that CO2 is effectively sequestered. The major challenge now is to determine, to what extent and under what conditions, will it be possible to replicate these projects in a wide variety of geological settings on the order of 1,000 times the scale of the current effort. Individual sequestration projects need to accommodate on the order of 40 to over 200 Mt over the lifetime of the facility. The large scale of challenge raises a number of remaining issues that must be addressed to enable the transition this technology from a niche opportunity for emission reductions, to a major contributor to reducing greenhouse has emissions over the coming century. This paper will identify and discuss these issues, namely;

1. Are there poorly understood geochemical interactions or geomechanical effects from CO2 injection that could compromise the effectiveness of a sequestration project?
2. How much does pressure buildup in the storage formation limit storage capacity, and how should we account for this in local, regional and global capacity estimates? What approaches are available for managing pressure buildup during large scale injection? When might they be needed?
3. For large scale injection, where does the displaced water go and what is the risk to groundwater?
4. What will be the footprint of the CO2 plume, how big is it and where does it migrate? How can we make more reliable predictions?
5. From prospectivity to selecting real sites… how do we gain confidence for selecting sites, and in particular, what are the best ways to characterize a seal?
6. Monitoring strategies and detection limits… What are cost effective approaches for assuring local environmental protection and carbon emission accounting?
7. If a CO2 leak occurs, what can be done to stop it? How much will it cost and how long will it take?