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The In Salah CO2 Storage Demonstration Project: Short-term Monitoring to Constrain Long-term Verification

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SUMMARY

The In Salah project in Algeria is an industrial-scale CO2 storage project that has been in operation since 2004. CO2 from several gas fields, which have a CO2 content of 5-10%, is removed from the production stream to meet the sales gas export specification of 0.3% CO2.

The project has several key features which make it unique among the early-mover CCS demonstration projects. The site is onshore in a remote desert location, with storage in low-permeability rock formations in the saline aquifer adjacent to a producing gas reservoir. This demonstration project is thus relevant to many candidate CCS sites in saline aquifers and depleted oil and gas reservoirs in continental locations close to major point-sources of CO2.

The key question the project had to address was which monitoring methods would be fit-for-purpose at this site. The criteria for determining this include: (a) ability of the method to detect CO2 migration as a fluid or gaseous phase, (b) the practical constraints for surface and down-hole tool deployment, and (c) cost. After a thorough and progressive review of the potential methods, the following monitoring portfolio has emerged:

Downhole gas analysis (as a baseline for subsurface gas distributions)
Surface gas analysis (as a baseline for surface gas distributions)
Production and injection wellhead monitoring (including pressures, temperatures, gas composition, and detection of injected tracers)
Micro-seismic event detection (deployed in a dedicated monitoring well)
Time-lapse 3D seismic (over a limited area of interest)
Satellite (InSAR) data to detect surface deformation
Tiltmeters and GPS stations to calibrate surface deformations
Groundwater wells (to measure base-line groundwater chemistry and flow and to deploy longer-term CO2 monitoring devices)
Core and well log data to characterise the reservoir and calibrate subsurface models.

The ongoing R&D programme, involving several partners supported by the US DoE and the European Commission, focuses on improved understanding of the coupled mechanical and multi-phase flow processes, and the corresponding input data and assumptions. Preliminary models show a CO2 migration pattern consistent with observations to date. Longer-term predictions are inherently uncertain, but the 5-year monitoring history does give us improved constraints to these uncertainties.