

# **CSLF CO<sub>2</sub> Monitoring Workshop, Rome, Italy, April 18, 2013**

## **Summary of Main Messages about the Current Status of Monitoring for CCS**

- 1) There are many and various technologies, techniques and methodologies, some already proven in the field, some still being tested, that are capable of indicating if the system behaves or not as predicted and desired.
- 2) Considering the great diversity of geological, vegetation and climatic conditions, monitoring for CCS should not be prescriptive, but rather it should be performance-based and driven by the specific conditions and objectives of the respective CCS project (tailored to project needs). Currently monitoring is mostly prescriptive and driven by research, regulatory requirements, public perception and environmental NGOs, which increases the cost of monitoring. The multitude of monitoring applied at the few existing projects is not sustainable for large-scale deployment of CCS.
- 3) Baseline data collection prior to starting injection is critical, both for needed background data and for identifying potential migration or leakage pathways. However, there are process based methods showing promise that do not require as much background data.
- 4) Monitoring should be cost effective. Initially a wide array of baseline and monitoring technologies should be used to reduce uncertainty and also to identify the best technologies to continue over the long term. However, as the project evolves, the redundancy should be eliminated and maybe even the monitoring frequency should be reduced if system stability is identified.
- 5) Monitoring also has to address modelling needs (in terms of data to improve the quality of forecasting the behaviour of the injected CO<sub>2</sub>).
- 6) Any CCS project needs to ask the right questions and set MMV objectives in order to establish monitoring strategies, choose appropriate techniques and technologies, and get the desired answers. There is no such thing as “one size fits all”.
- 7) Many near-surface monitoring methodologies are affected by environmental variations: diurnal, seasonal, annual and multi-annual, and care should be taken to obtain a representative time-series for baseline conditions and also to avoid false interpretations based on natural variations.
- 8) Emplacement of monitoring instrumentation and selection of sampling points are still a challenge. There are various possible approaches to this: 1) monitoring in the places most at risk; 2) monitoring at the sites more likely for undesired effects to occur; 3) using a “zero-in” approach by which large areas are inspected using satellite and flight-based technologies to identify sensitive spots which then are checked/monitored on the ground; and 4) a combination of the previous ones.
- 9) While quantification of CO<sub>2</sub> fluxes at the soil-air interface appears well developed, quantification of CO<sub>2</sub> amounts in the deep storage complex or overburden is not. Finding small, concentrated CO<sub>2</sub> leaks over large areas is still a challenge but progress is being made using remote sensing techniques. The ability to do so has been demonstrated at natural sites where remote sensing has identified small gas vents in large calderas.