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**Agreement Number: FWP-ESD-14-095**

**Performer: Lawrence Berkeley National Laboratory**

**Key Technologies:**

- **Task 2 – Field Testing of Emerging Technologies**

This task is leveraging research conducted under previous funding cycles by taking newly developed or existing monitoring technologies and improving them. The specific aim is to develop technologies to improve reservoir storage efficiency while ensuring containment effectiveness. Researchers are deploying or will be deploying these technologies at several CCS (and non-CCS) project sites for testing. The project sites include: Otway, Australia; Aquistore, Canada; the Carbon Management Canada site; and Mont Terri Underground Research Lab, Switzerland. At the start of the project, the currently deployed technologies (at Otway and Aquistore) are undergoing testing and performing data collection. The collected data is being used to validate and verify the technologies under in-situ conditions.

- **Task 3 – Advancing Monitoring Technology**

This task is investigating continuous seismic and EM monitoring technologies that would be advanced and used for CO<sub>2</sub> plume monitoring at storage sites. The research performed as part of this project ranges from the conceptual/lab scale to pilot scale. Technologies being developed include fiber optic distributed acoustic sensing (DAS), semi-permanent seismic sources (rotary source), and electromagnetic (EM) sensing deployed in a cross-well arrangement.

- **Task 4 – Optimization Framework for Improved CO<sub>2</sub> Injectivity, Storage Permanence, Monitoring, and Utilization**

This task is developing an integrated optimization framework to develop adaptive optimization methods and associated simulation tools and to address key challenges in CO<sub>2</sub> storage, providing new cost effective methods for improved injectivity, storage efficiency, and permanence for storage projects.

- **Task 5 – U.S.-Japan CCS Collaboration on Fibre-Optic Technology**

This collaboration of scientific teams from Research Institute of Innovative Technology for the Earth (RITE) and LBNL will focus on advancing fiber-optic sensing technology for monitoring carbon sequestration. Distributed strain sensing (DDS) will be used to monitor geomechanical processes during CO<sub>2</sub> injection. Using the CaMI FRS Site, scientists from RITE will operate a Rayleigh based strain monitoring system while LBNL will utilize an analogous system based on Brillouin technology. The data gathered using these systems will be used to assess the maturity of DSS for providing critical information on hydro-mechanical coupling. Coupled fluid flow and geomechanical modeling will be performed using the TOUGH-FLAC numerical simulator; a combination of LBNL's TOUGH2 multiphase flow and heat transport simulator with the FLAC3D geomechanical simulator.

- **Task 6 – Mont Terri Project**

The Mont Terri fault slip experiment will explore changes in permeability associated with slip activation of a clay rich fault zone, similar to a nearly undetectable fault, during the initial design of a storage site. Current modeling efforts at LBNL will continue toward a focus on understanding the relationship between fault movement and the resulting change in permeability. Collaborations between Swisstopo and JAEA will continue to (1) relate the estimated stresses to the fault zone structure, and (2) compare laboratory-scale with field-scale fault zone frictional property variations during injection.

## **Technology Areas:**

- Geologic Storage (GS)
- Monitoring, Verification, Accounting, and Assessment (MVAA)