MVA Activities - SWP Farnsworth Unit Project

Rich Esser1, Ning Liu2, Brian McPherson1, Reid Grigg2, Robert Balch2, Leonard Garcia2, Tianguang Fan2

1 Dept of Civil Engineering, Univ of Utah, SLC, UT 2 PRRC, New Mexico Tech, Socorro, NM

MVA Strategy & Methods

The SWP Farnsworth Unit MVA program is designed to provide the data needed to characterize injected CO2 and existing reservoir fluids, including volumes of CO2 injected, produced, recycled and ultimately stored; fluid migration; and identification and quantification of any potential release of CO2 and/or fluids from the reservoir. The MVA data will be used to facilitate effective simulation results and risk assessment for underground sources of drinking water (USDW - Ogallalla formation), the shallow subsurface, and atmosphere.

Monitoring & Verification in Target/Non-Target Reservoirs:

- Monitoring CO2 at surface
  - Detecting CO2 and/or other fluid migration in Target/Non-Target Reservoirs

Tracking CO2 Migration and Fate:

- Groundwater chemistry (USDWs)
- Water and Gas Tracers
- Self-potential (detection of minute electrical changes caused by subsurface fluid migration)
- Microgravity surveys

Monitoring CO2 at surface:

- Eddy covariance towers for measuring atmospheric CO2 and CH4 fluxes, used to constantly monitor large areas for increases in gas emissions and identify point source emissions.
- Surface flux measurements to detect possible CO2 emissions from depth.

Detecting CO2 and/or other fluid migration in Target/Non-Target Reservoirs:

- Groundwater chemistry (USDWs)
- Water and Gas Tracers
- Self-potential (detection of minute electrical changes caused by subsurface fluid migration)
- Microgravity surveys

MVA Results to Date

Baseline and Operational MVA at Farnsworth Unit

- Baseline begun in 2013; operational monitoring started in 2015.
  - USDW and reservoir fluid samples now collected/analyzed on a quarterly basis
  - CO2 soil flux collected quarterly; CO2/CH4 eddy flux collected continuously.
  - Borehole seismic collected continuously; periodic crosswell/VSP surveys.

- In situ pressure and temperature (DTS) collected continuously (currently 1 well).
- Water and gas phase tracers injected in multiple wells; monitored at surface/sub-surface.
- CO2 water (injection and production), oil (production) accurately metered daily.
- Self-potential and microgravity data collected continuously.

MVA Database

All non-seismic MVA data collected by the SWP is incorporated into a relational database

- Built on open-source software (HydroServer & MySQL)
- Benefits of relational database architecture:
  - Fast, efficient and complex queries
  - Automated data uploads/downloads
  - Access to real-time/near real-time data
  - "Portability" to other software platforms:
    + GIS
    + PHP/Python for automated analysis, dynamic graphing
    + Web clients/browsers
  + SWP MVA Database: 770 Sites, 79 Variables, 259,046 data points and increasing daily