Sim-SEQ Work in 2010-2013

Approach

- Participating modeling groups performed simulation analysis of selected field tests, including SECARB (Cranfield) and SWP (Aneth)
- Using the similar site characterization data, modeling groups used different conceptual approaches and numerical simulators
- Results werecompared with monitoring data and among different modeling groups
- For SWP, the resulting outcome at Aneth illustrated that microseismic events could be used to elucidate previously unobserved geologic structures (small fault zones);
- Also, we determined that brine injection, not CO_2 injection, was responsible for detected micro-events (magnitudes < 1)

SWP Research Facilitated via NRAP since 2013

- “Revisit” of SACROC Phase 2 project and forecasts of storage at that EOR site

Jia, W., McPherson, B., Pan, F., Xiao, T., Bromhal, G. (2016). Probabilistic Analysis of CO_2 Storage Mechanisms in a CO_2-EOR Field Using Polynomial Chaos Expansion. ***International Journal of Greenhouse Gas Control***, 51, 218-229

This paper focused specifically on development of Reduced Order Models to quantify uncertainty of storage estimates forecasted for that project, which concluded in 2010.

SWP Research Facilitated via NRAP

- Quantification of uncertainty of forecasts of CO2 storage, reservoir pressure and oil production as a function of multiphase flow parameters (relative permeability, (to be discussed tomorrow morning at 8 am)

Pan, F., **McPherson, B.**, Dai, Z., Jia, W., Lee, S., Ampomah, W., Viswanathan, H. (2016). Uncertainty Analysis of Carbon Sequestration in an Active CO_2-EOR Field. ***International Journal of Greenhouse Gas Control***, 51, 18-28.

This study focused exclusively on making sense of uncertainty stemming from multiphase flow parameters in a CO2-EOR operation.

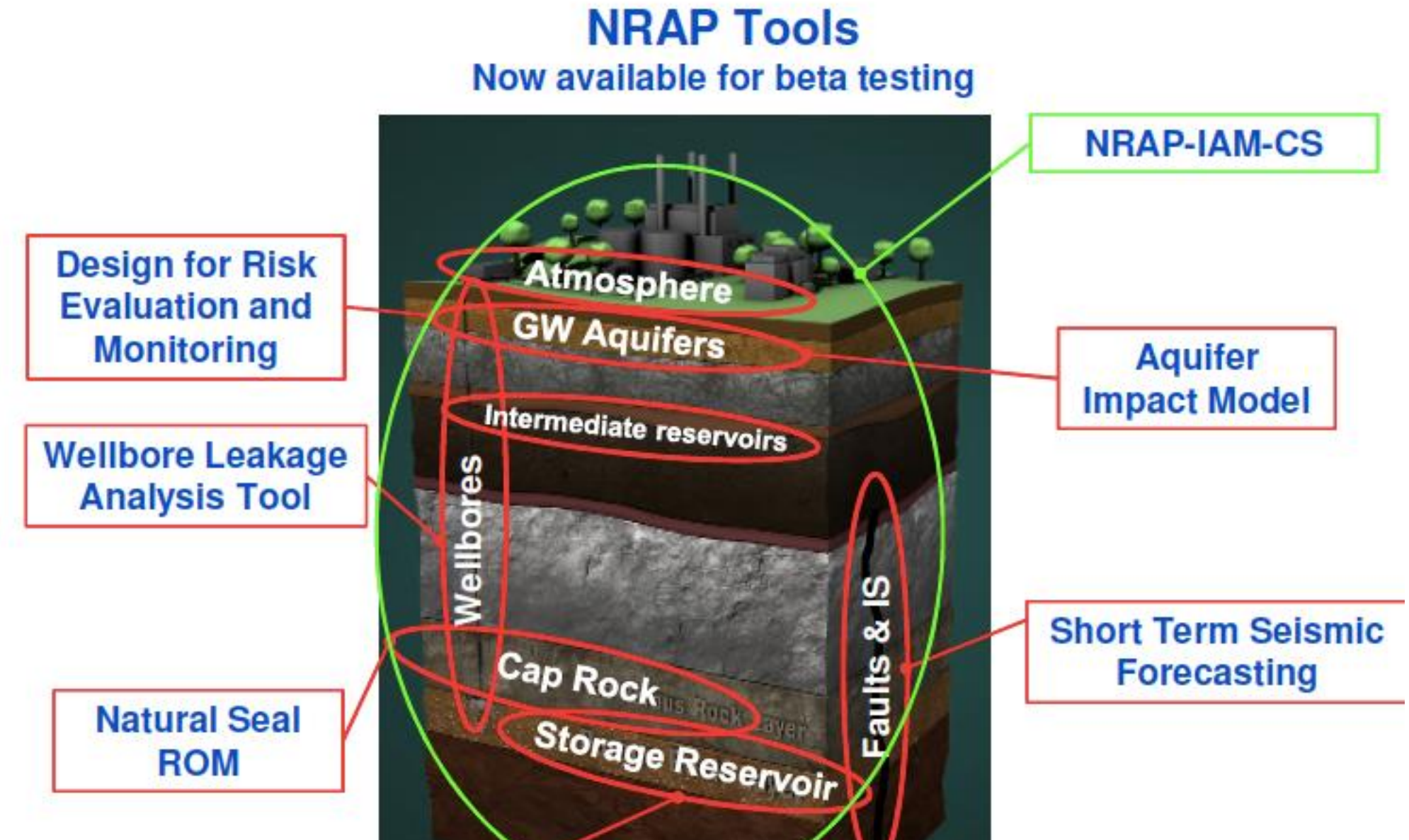
SWP Research Facilitated via NRAP

- Evaluation of potential USDW impacts – specifically, assessment of risks to the Ogallala aquifer above the SWP Farnsworth Unit Phase 3 project (to be discussed tomorrow morning at 8 am)

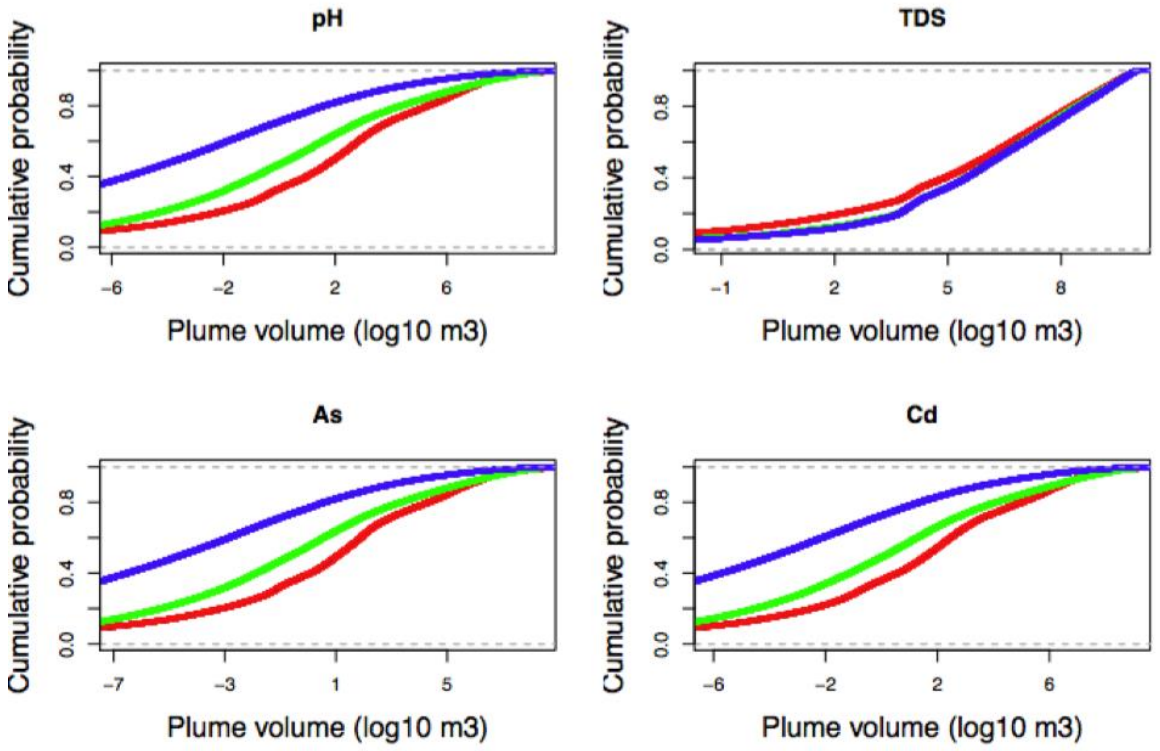
Xiao, T., McPherson, B., Pan, F., Esser, R., Jia, W. (2016). Potential Chemical Impacts of CO_2 Leakage on Underground Source of Drinking Water (USDWs) Assessed by Quantitative Risk Analysis. ***International Journal of Greenhouse Gas Control***, 50, 305-316.

This study focused on development of ROMs calibrated with traditional reactive transport models. We subsequently examined potential aquifer impacts using NRAP's AIM tool.

Probabilistic Analyses Using NRAP's AIM Tool



Probabilistic Analyses Using NRAP's AIM Tool



Cumulative distribution function of impacts on aquifer (pH, TDS, As, and Cd) due to three levels of leakage

Analyte	U.S. EPA Regulatory Standard MCL Threshold
pH	6.5
Total Dissolved Solids	500 mg L^{-1}
Arsenic	10 µg L^{-1}
Cadmium	5 µg L^{-1}
Lead	15 µg L^{-1}