# Natural CO<sub>2</sub> Reservoirs on the Colorado Plateau & Southern Rocky Mountains: Candidates for CO<sub>2</sub> Sequestration

### R Allis<sup>1</sup>, T Chidsey<sup>1</sup>, W Gwynn<sup>1</sup>, C Morgan<sup>1</sup>, S White<sup>2</sup>, M Adams<sup>3</sup>, J Moore<sup>3</sup> <sup>1</sup>Utah Geological Survey, Utah, <sup>2</sup>Industrial Research Ltd, New Zealand, <sup>3</sup>Energy and Geoscience Institute, University of Utah



### **Project Objectives**

- What can we learn from natural CO<sub>2</sub> reservoirs about trapping structures, fluidrock interactions, permeability characteristics?
- What happens when CO<sub>2</sub> leaks from these natural reservoirs?
- Based on constraints from natural analogs, simulate CO<sub>2</sub> injection and storage near

Mine-mouth coal-fired power plant on Colorado Plateau, central-Utah — could separated CO<sub>2</sub> from flue gases be sequestered subsurface near here? existing power plants in Colorado Plateau-Southern Rocky Mountains region.

## Some Characteristics of Natural CO<sub>2</sub> Reservoirs

- They are not obviously different from natural gas reservoirs!
- About 10 have been exploited for their gas
- Five fields still in production; largely for EOR
- They occur in structural highs
- Dominant reservoir lithologies are sandstone, dolomite and fractured basement
- Dominant seals are low permeability mudstone/shale, anhydrite
- Permeability anisotropy in the sedimentary section ensures horizontal dimensions (~ 10 km) are typically 100 times greater than thickness
- Multiple, stacked reservoirs are common, suggesting vertical movement of CO<sub>2</sub> up through section
- Evidence of leakage to surface at several CO<sub>2</sub> fields where carbonate deposits and CO<sub>2</sub>-charged groundwater occur
- At Big Piney-La Barge field (WY), the gas reservoir is vertically segregated (CH<sub>4</sub> over CO<sub>2</sub>)
- The CO<sub>2</sub>-associated production waters are very



Natural CO<sub>2</sub> occurrences around the Colorado Plateau -Southern Rocky Mountains, together with CO<sub>2</sub> emissions from fossil-fueled power plants (red dots). Approximately 33 million tons a year of CO<sub>2</sub> is used for enhanced oil recovery, or is vented. (CO<sub>2</sub> emissions map from S. Hovorka, 1999)

corrosive (usually requiring fiberglass liners)

### What happens when CO<sub>2</sub> leaks to the surface?



Example from Crystal Geyser, Green River, Utah; an abandoned well on a fault zone marked by travertine is now a CO<sub>2</sub> geyser, depositing Fe-bearing travertine.

## Simulating CO<sub>2</sub> Sequestration







Farnham dome  $CO_2$  field, near Wellington, central Utah. The field produced 135 million m<sup>3</sup> of 99% pure  $CO_2$  between 1931- 1972. It is an example of the geological features beneath several big power plants on the Colorado Plateau — note stacked reservoirs. The right side (SE) of the cross-section is used for simulating  $CO_2$  sequestration.



Scenario 1 — low permeability layers = 0.01 mD; Inject 50 kg/s of CO<sub>2</sub> for 10 years. Modeling shows the injected CO<sub>2</sub> is largely contained at depth (after 1000 years).



Scenario 2 — low permeability layers = 0.01 mD; Inject 50 kg/s of CO<sub>2</sub> for 10 years. Modeling shows the injected CO<sub>2</sub> has risen to the surface after 500 years.



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