The Frio Brine Pilot Experiment: Managing CO_2 Sequestration in a Brine Formation

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Frio Brine Pilot Experiment- Overview, Core Analysis, Pulsed Neutron Capture (PNC), CO_2 Saturation, Fluid Substitution

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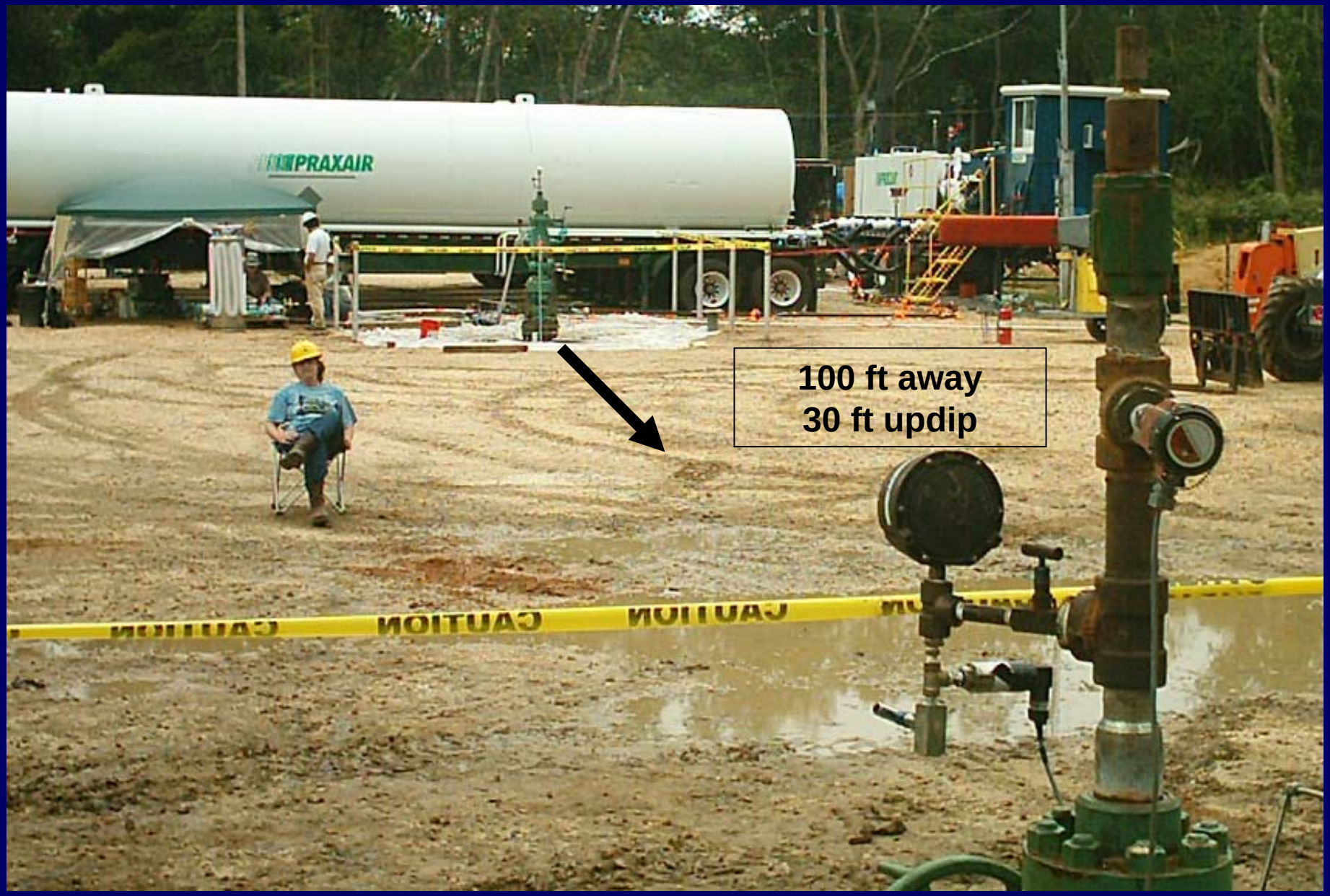
New Model

- Larger porosity and permeability
- Change in perforation intervals

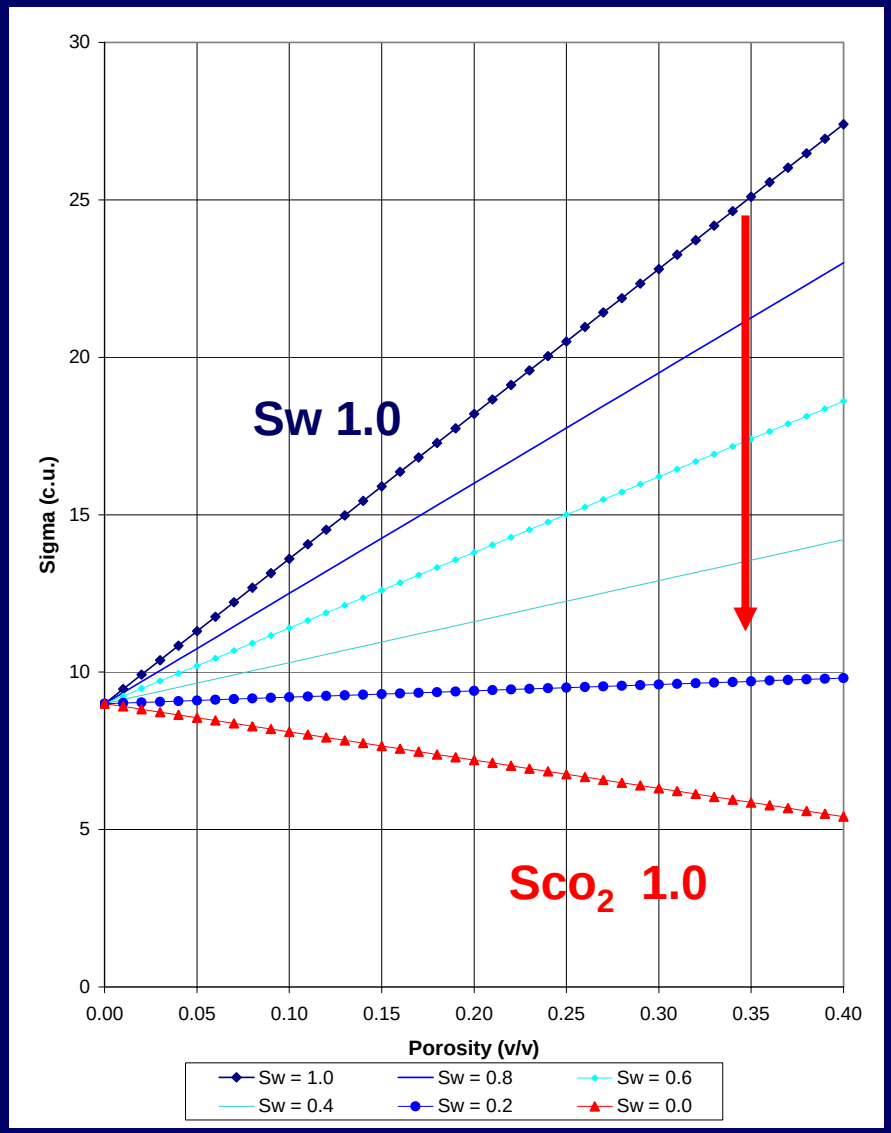
Outline

- Introduction
- New Injection Well
  - Core and Wireline Logs
- Monitoring of CO_2 Distribution
  - Monitoring by Cased-Hole Log
  - Tying to Geophysical Data

Monitoring of CO_2 Distribution



CO_2 Saturation from PNC
Pulsed Neutron Capture

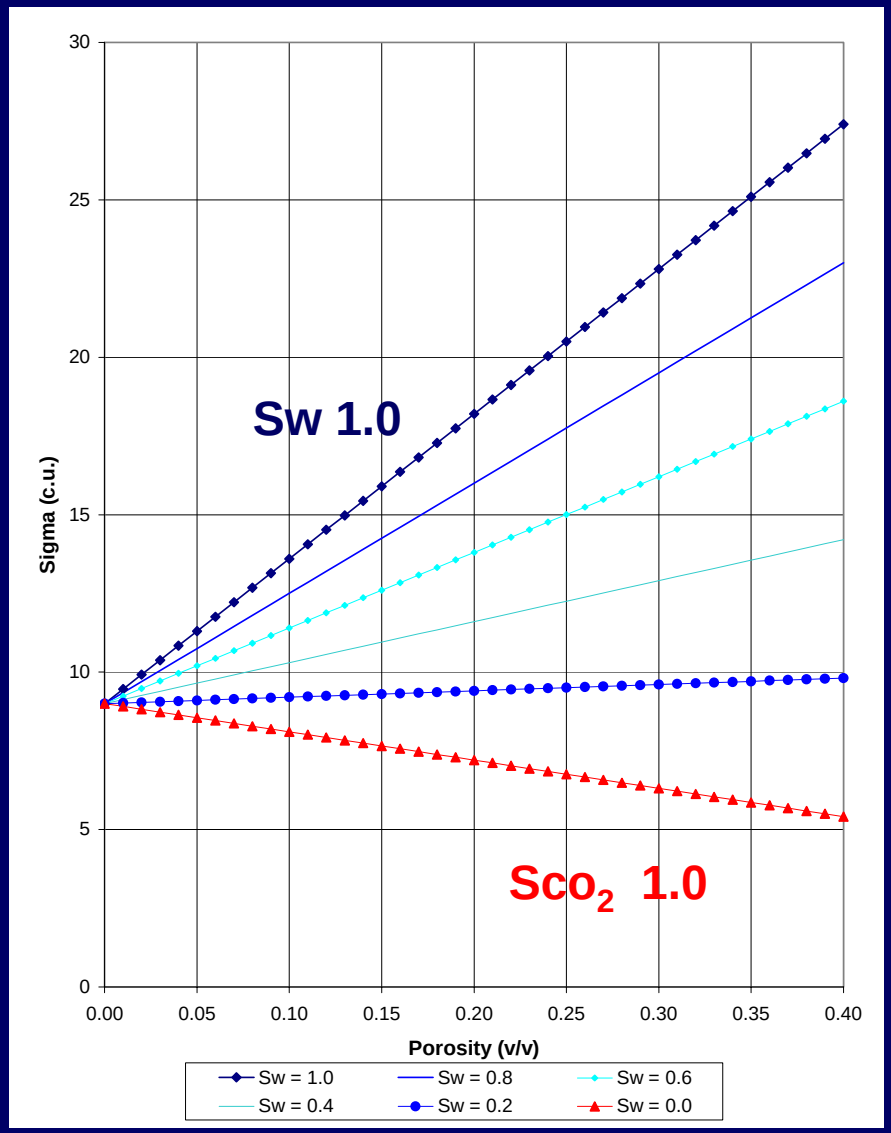


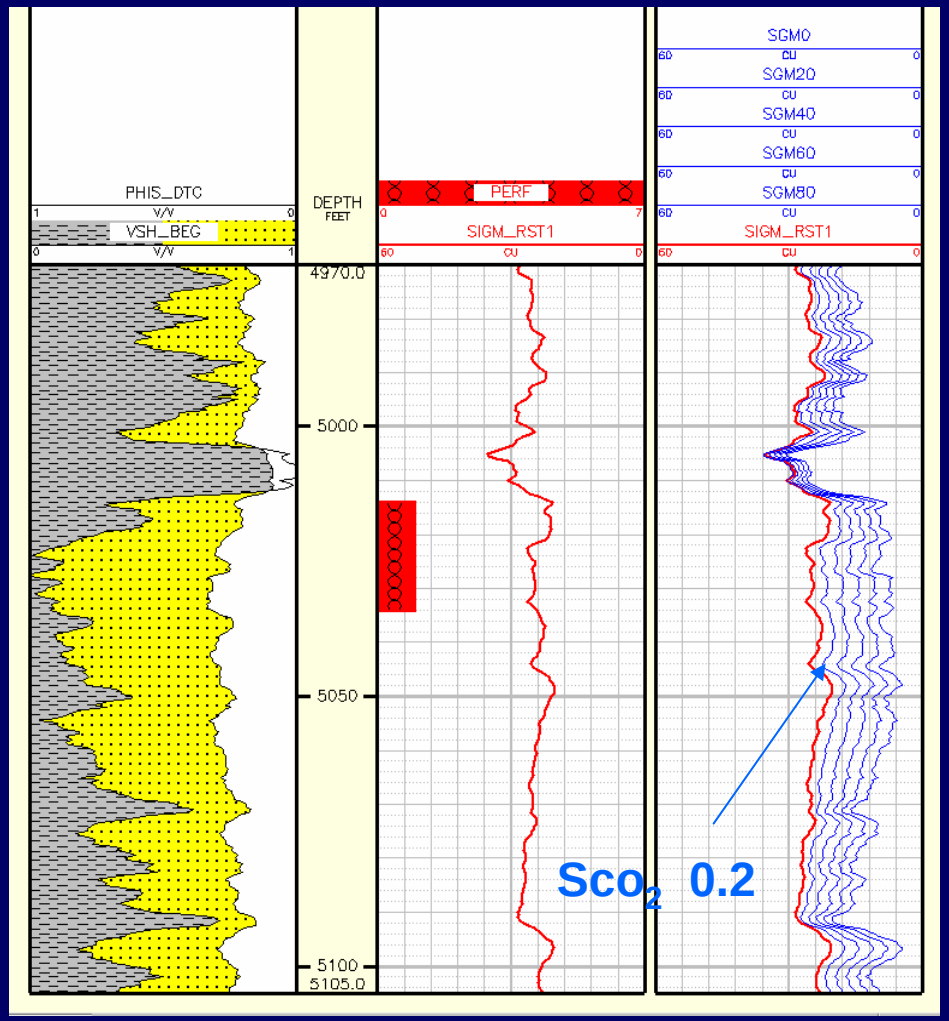
Large contrast of sigma between CO_2 (0.03 c.u.) and formation water of 93,000 ppm (55 c.u.)

High porosity of as much as 35%

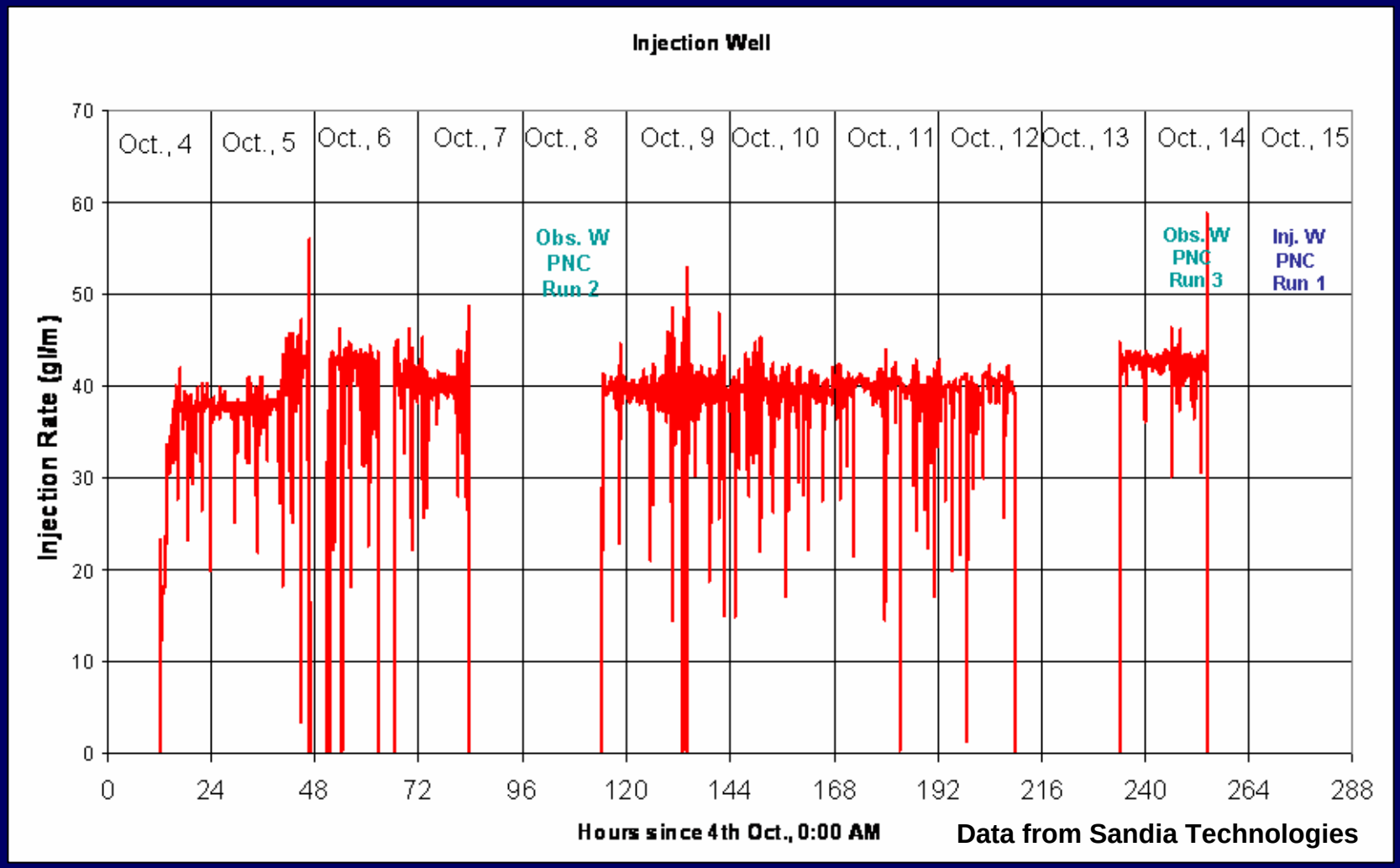
Can expect significant sigma changes

CO_2 Saturation from PNC



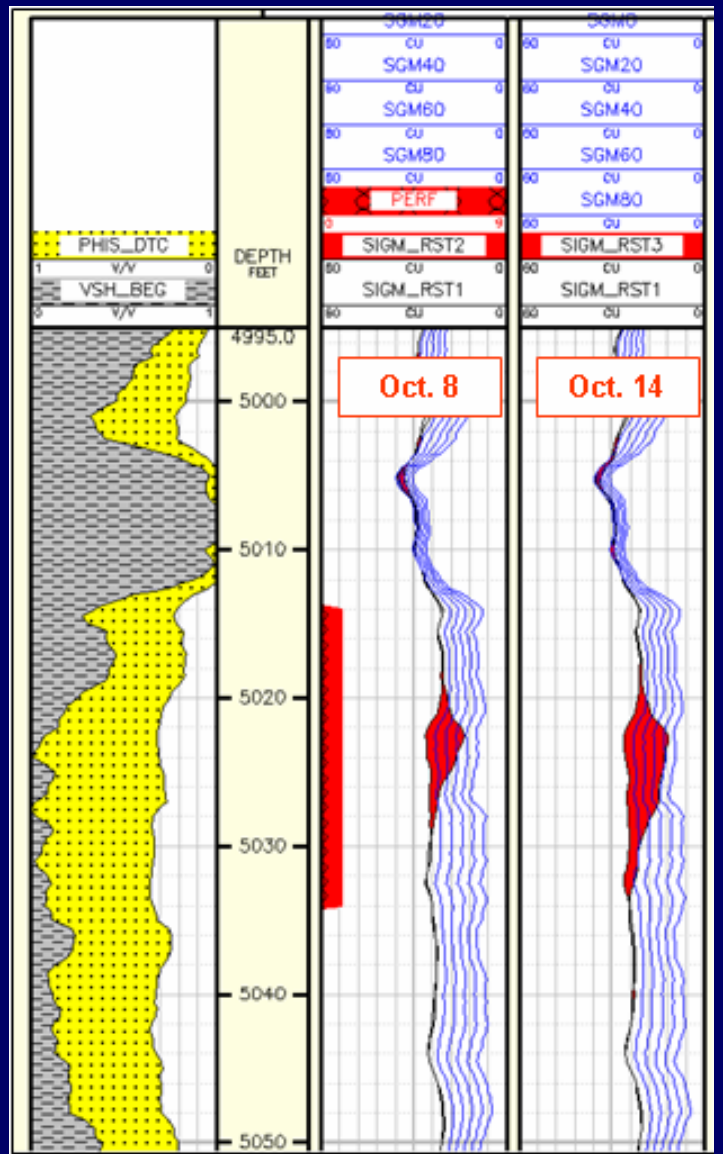


CO_2 Injection Rate



Injected 1,600 tonnes of CO_2

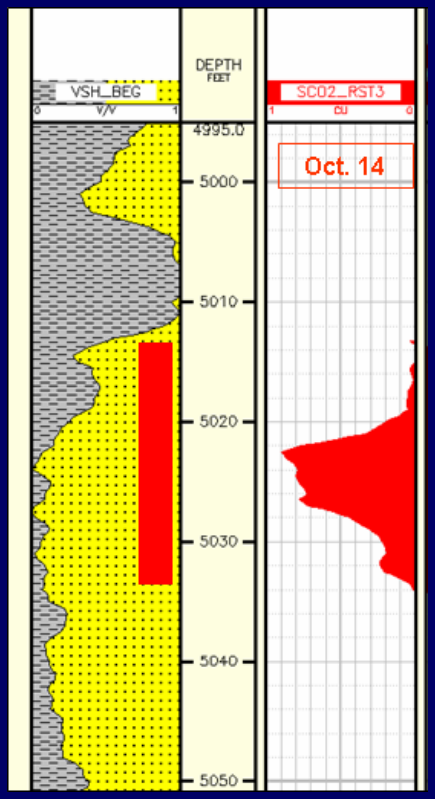
Change of thermal absorption cross section Observation Well



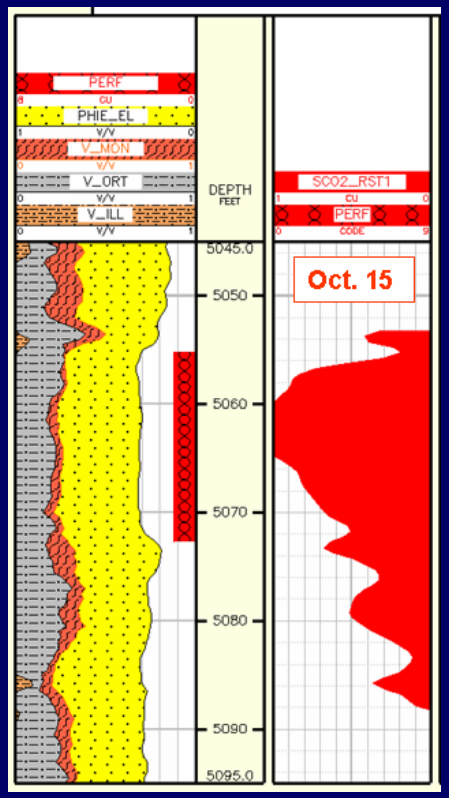
Change of CO_2 Saturation

* Saturation from PNC for end of injection

Observation well

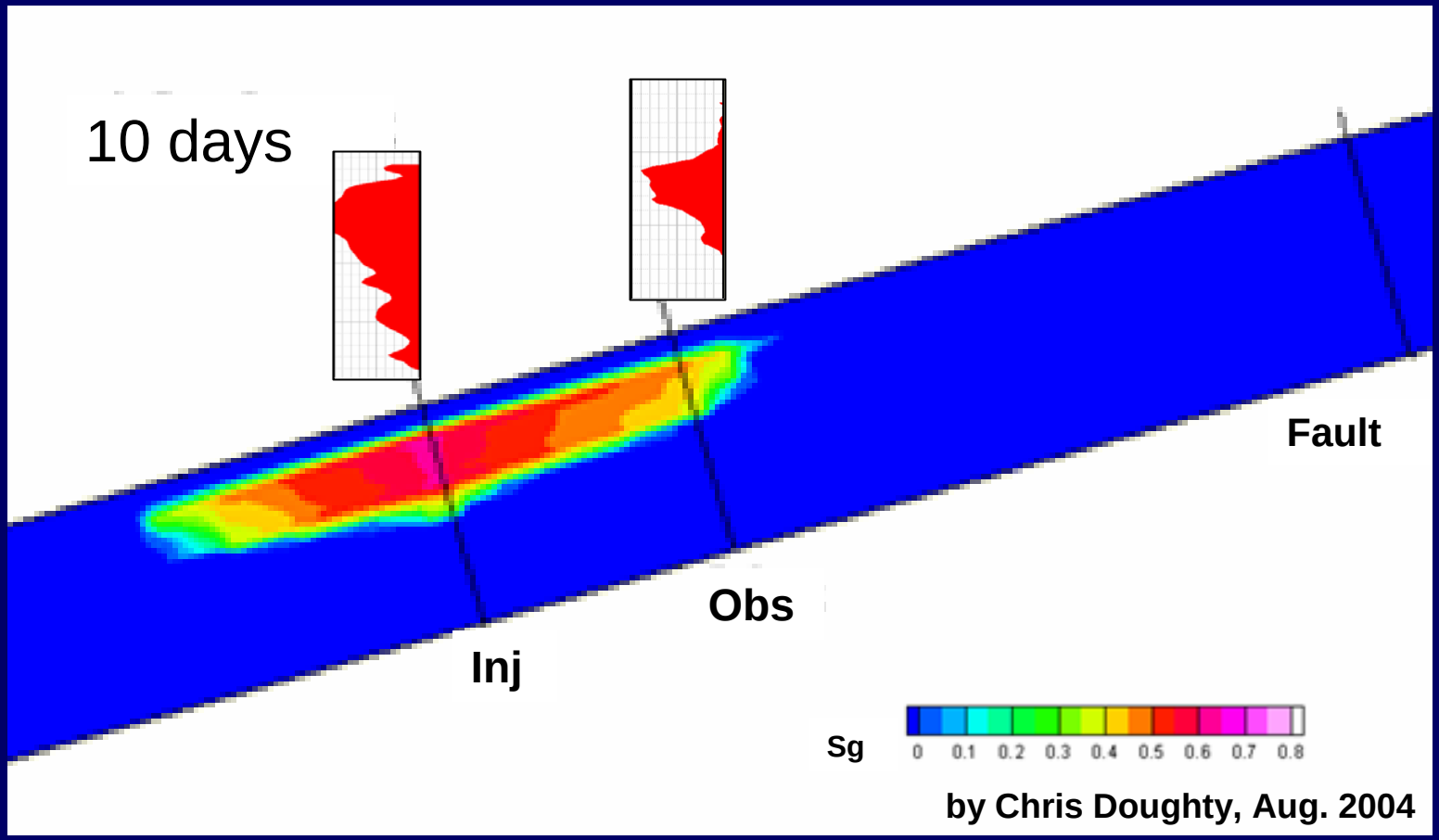


Injection well



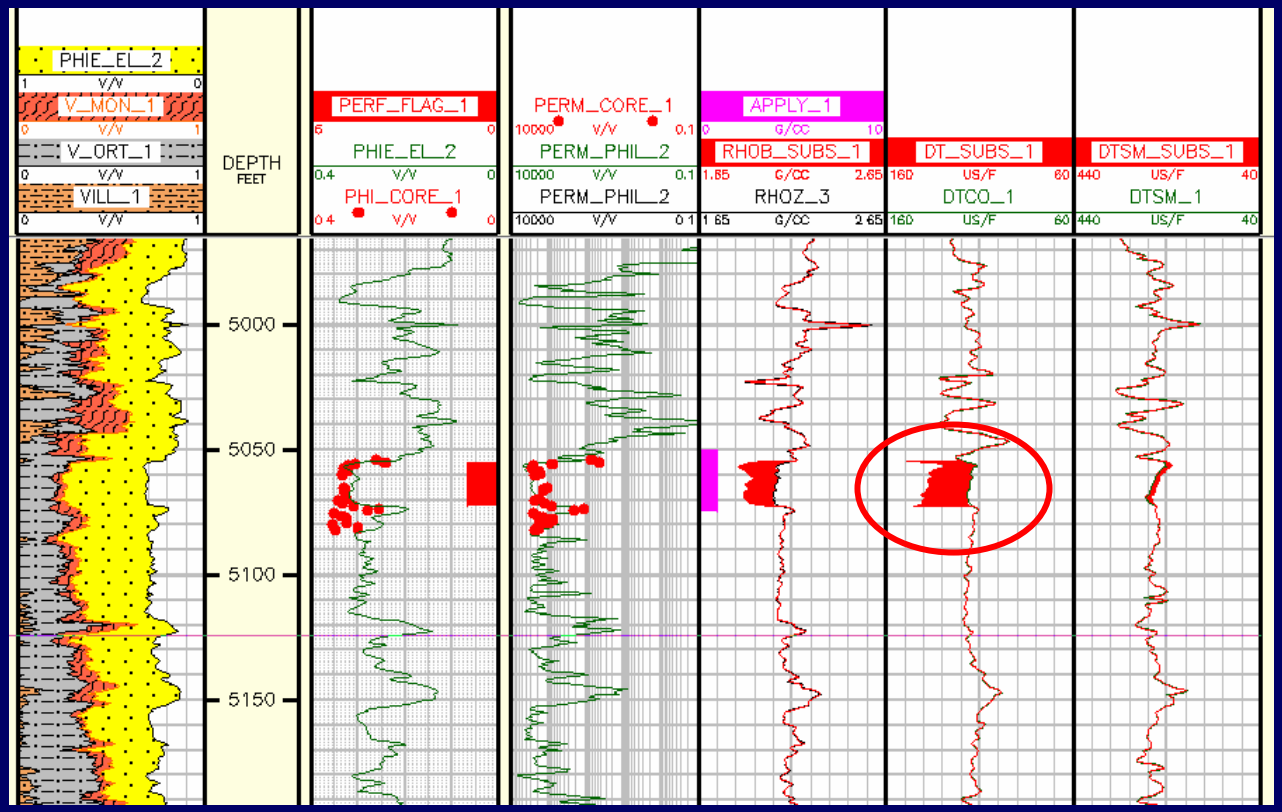
Comparison of CO_2 Saturation

PNC and Model Result



Change of Velocity with CO_2

Fluid Substitution



Assumed that CO_2 replaced formation brine in C sand

Expect lower density and slow velocity

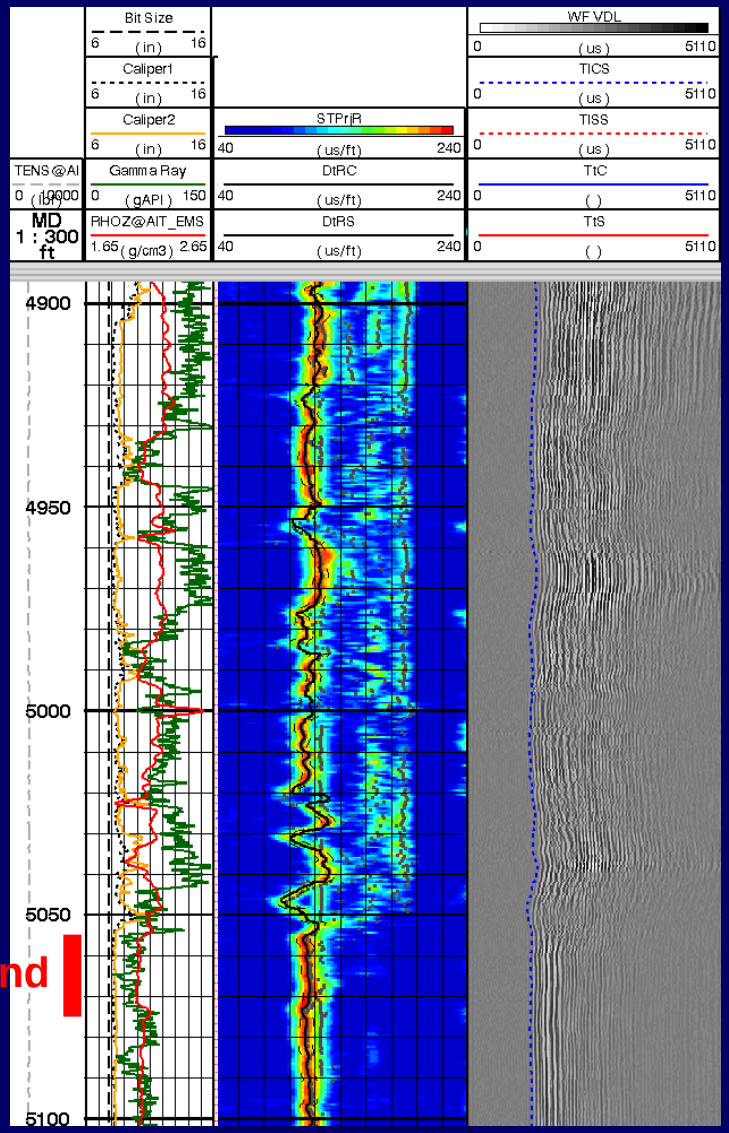
Dtco changed from

115 to 140 us/f or

3.05 to 2.27 km/s

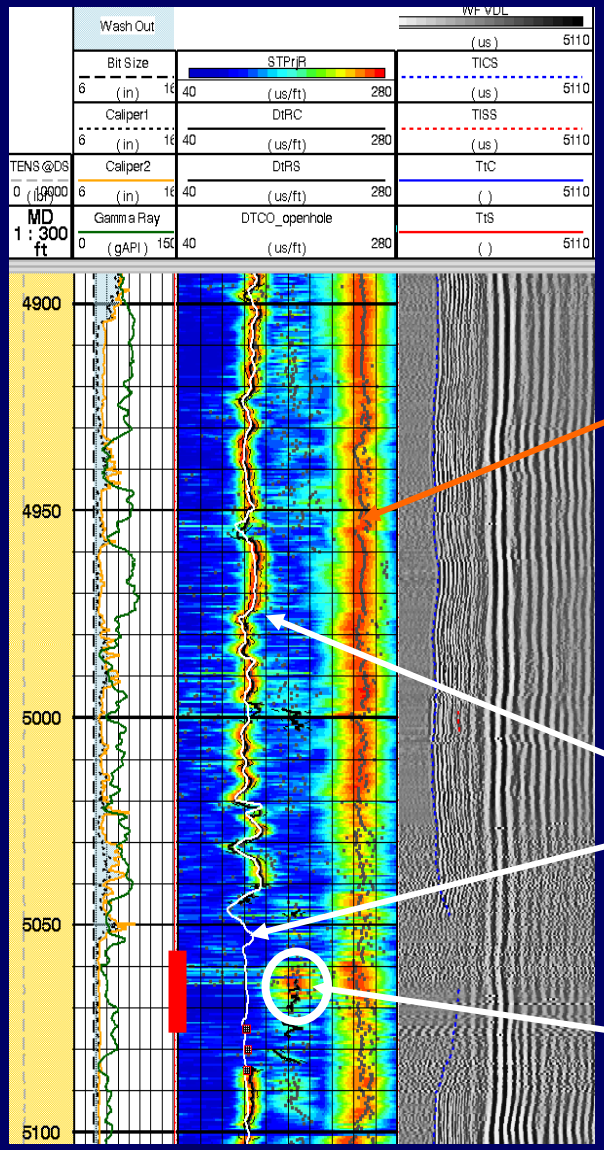
Sonic Transit Time Before and After Injection

Baseline open-hole log



C sand perf.

Postinjection cased-hole log



Mud signal

OH Dtco overlay

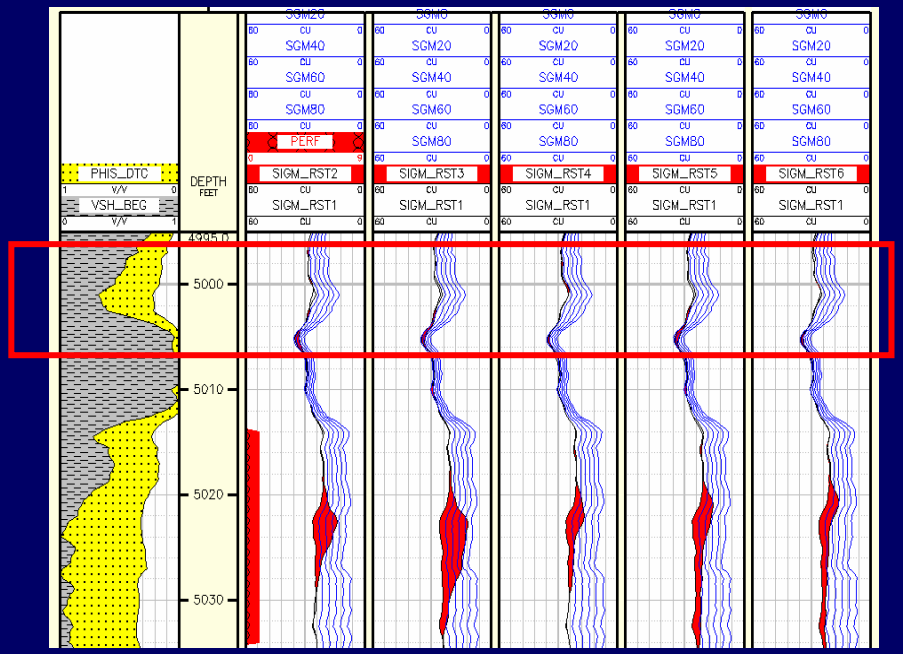
Alias compressional ?

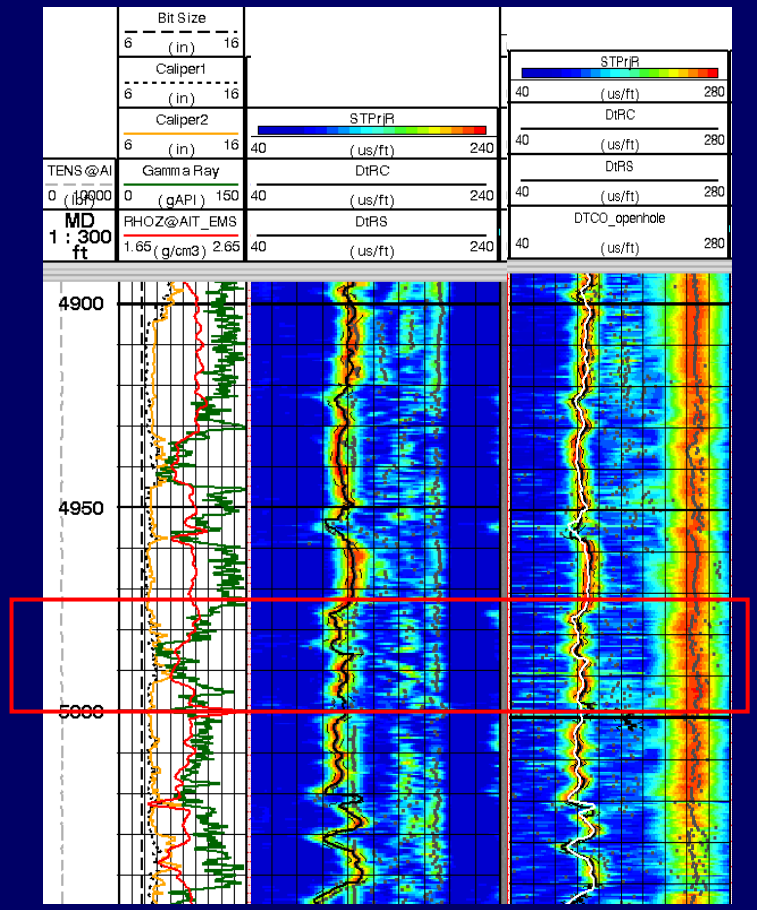
Velocity Change

- See LBNL's results on VSP and crosswell tomography
- Will test new sonic tool on Phase II

CO_2 Migration up to B Sand

- Monitor log data to see migration of CO_2 to shallower interval





No change in sigma

No change in Dtco

CONCLUSIONS

- Injected 1,600 tonnes of CO_2 safely into brine-filled formation
    - No leaks into shallow B sand
- PNC worked well for CO_2 saturation estimate
    - Large contrast of sigma and high porosity
- Reasonable agreement between CO_2 saturation from wireline logs and that predicted by simulation model
- Plan for Phase II (deeper sand) next year
    - No borehole changes

Thank You