WEST COAST REGIONAL CARBON SEQUESTRATION PARTNERSHIP
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WESTCARB Annual Business Meeting

Rosetta Resources CO_2 Storage Project

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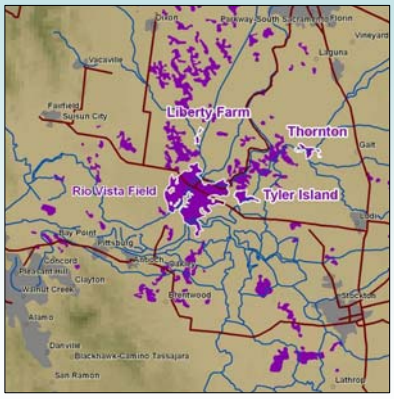
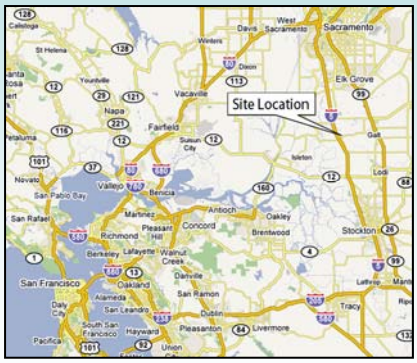
Site Selection Process

- Developed detailed site selection criteria:
  - Public Safety
  - Scientific
  - Logistics
- Prioritized and ranked criteria
- Reviewed site data
- Ranked sites based on criteria
- Selected Thornton Gas Field out of 9 sites



Thornton Gas Field Regional Site Attributes …



- Near major metropolitan areas offering products and services
- Near large industrial CO_2 point sources
- Along major transportation corridors providing easy site access
- Located near active natural gas fields and pipe line corridors in the Southern Sacramento Basin

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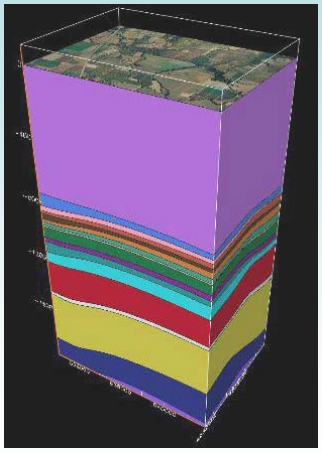
Thornton Gas Field Geologic Attributes …

- Stacked reservoir with multiple seals
- Thin depleted gas reservoir and saline zones greater than 1 km deep
- Thornton Gas Field is representative of numerous gas fields with 1.7 Gt CO_2 capacity in CA
- Thornton Gas Field is an analog for the Rio Vista field, the largest on shore natural gas field in CA (3.3 Tcf)



Thornton Geologic Model (courtesy Jeff Wagoner and Julio Freidmann, LLNL)

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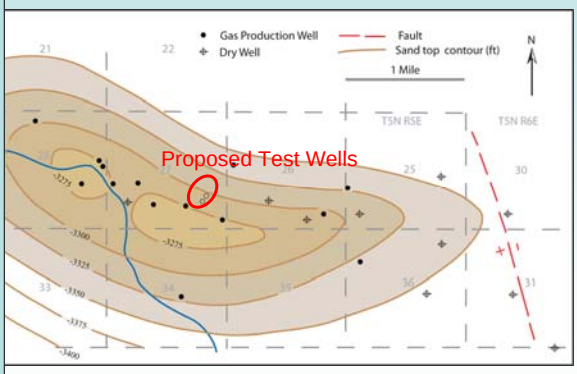
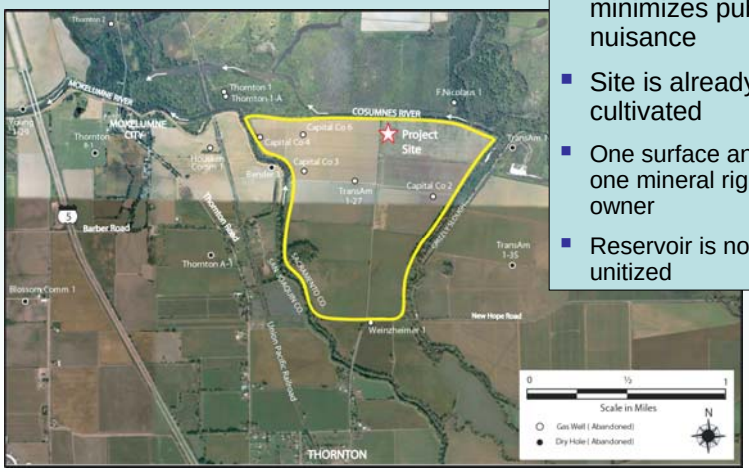
Thornton Gas Field Geologic Attributes …

- Well defined anticline will safely store injected CO_2
- Existing wells and field have been abandoned
- Attic gas may be present providing potential economic incentive
- Located in the Central Valley where earthquake activity is relatively low

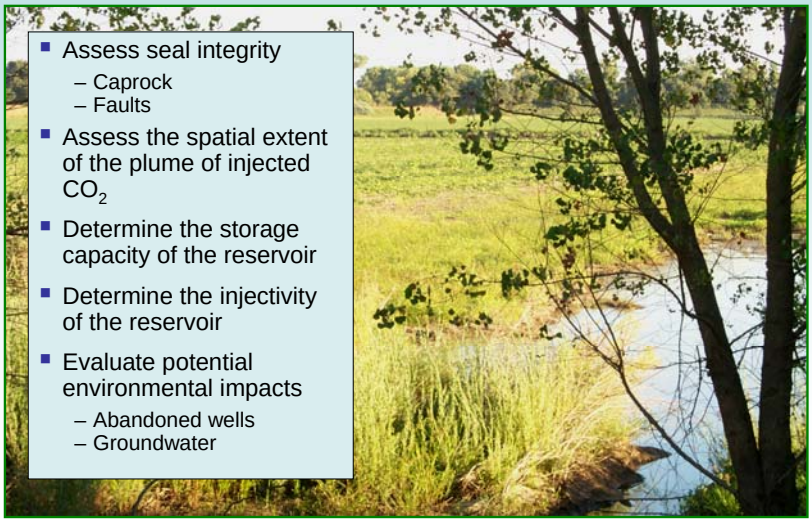


Thornton Gas Field Logistical/Cultural Attributes…

- Rural setting minimizes public nuisance
- Site is already cultivated
- One surface and one mineral right owner
- Reservoir is not unitized



Objectives Common to Saline and Gas Zone Pilot Tests



- Assess seal integrity
  - Caprock
  - Faults
- Assess the spatial extent of the plume of injected CO_2
- Determine the storage capacity of the reservoir
- Determine the injectivity of the reservoir
- Evaluate potential environmental impacts
  - Abandoned wells
  - Groundwater

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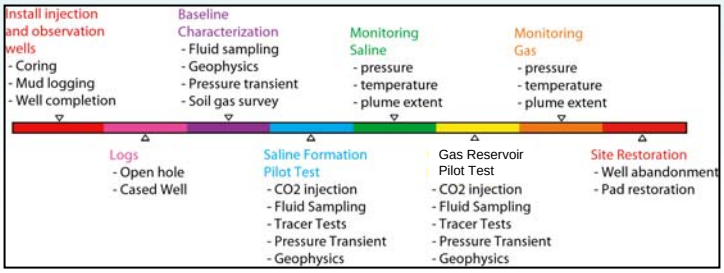
Test Sequence

- Four Main Elements
  - Well installation and baseline characterization
  - CO_2 injection
  - Monitoring
  - Site restoration



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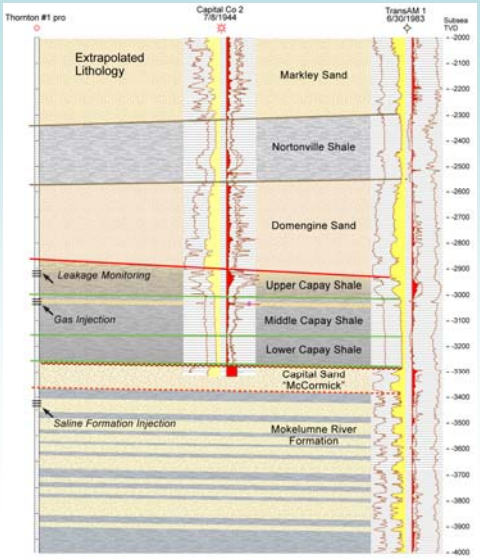
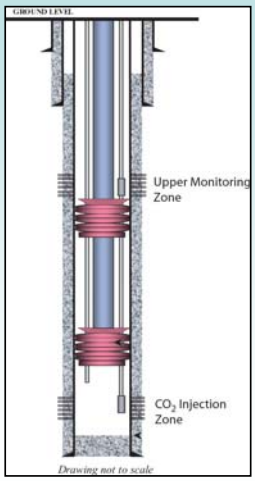
Well Installation and Baseline Characterization

- Dual completion
- Mudlogging
- Coring
- Open hole and cased well logs
- Baseline fluid sampling
  - Composition
  - Fluid properties
- Short-duration transient pressure testing
- Environmental sampling

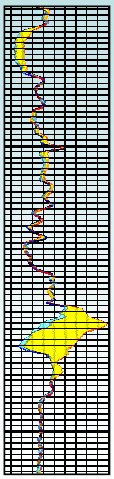


Assess Seal Integrity

- Geomechanical analysis
  - Safe injection pressure
- Monitor pressure and water quality in a shallow formation above injection zone
- Obtain RST logs from injection and observation wells before and after CO_2 injection



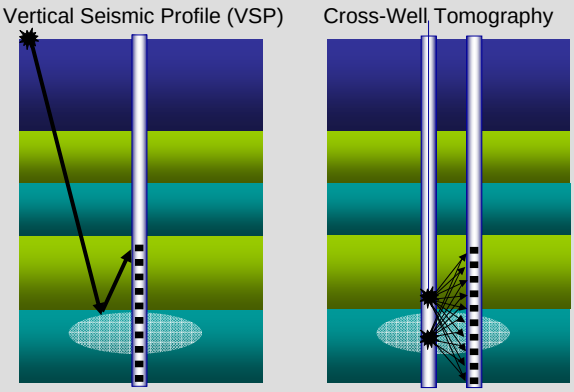
Pressure Monitoring



RST Log

Assess the Spatial Extent of the CO_2 Plume

- Seismic Imaging
  - Vertical seismic profiling (VSP)
  - Cross-well seismic



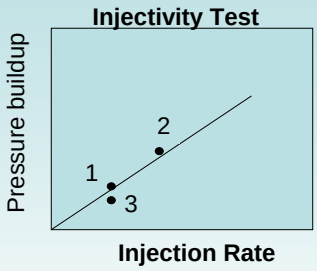
Assess Storage Capacity

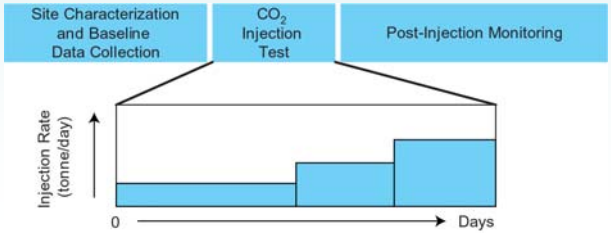
- Separate Phase CO_2
  - Fluid sampling
  - Seismic imaging
  - RST Log
- Dissolved CO_2
  - Natural and introduced tracers

U-Tube Sampler (Barry Freifeld, LBNL)

Determine the Injectivity of the Reservoir

- Inject CO_2 at three or more rates
- Measure pressure buildup in the formation

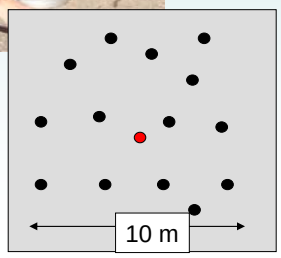




Evaluate Environmental Impacts of CO_2 Injection (Pre- and Post-Injection Surveys)

- Drill and sample shallow groundwater well
- Collect and analyze soil gas concentrations and fluxes in the vicinity of abandoned wells

Flux accumulation chamber



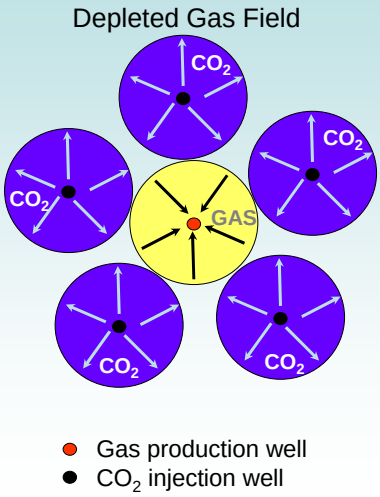
Gas sampling grid

Gas Reservoir Objective

- CO_2 Storage Enhanced Gas Recovery (CSEGR)

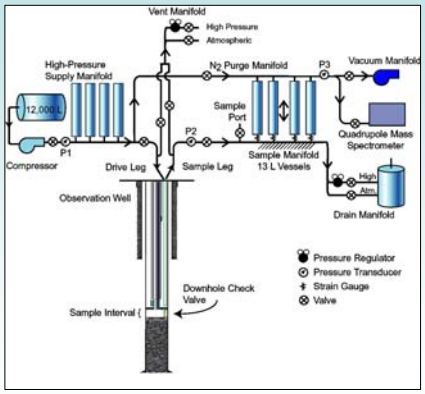
Primary Mechanisms

- Repressurize depleted natural gas reservoir using CO_2
- Use CO_2 to sweep natural gas toward producing wells



Gas Reservoir Pilot Test: Challenges

- Assess mixing between CO_2 and CH_4 causing methane dilution
- Sampling multi-component fluids with different phases
- Imaging CO_2 methane/water displacement is difficult



U-tube fluid sampler
(Freifeld and Trautz 2006)
Barry Freifeld, LBNL

Summary

The project is …

- Negotiating site access
- Gaining valuable permitting experience
- Developing important relations with state and federal regulators
- Reaching out to the Thornton community through public outreach

… has developed a

Comprehensive set of pilot test objectives, priorities and plans

and

Will begin testing in 2007