Shallow Injection Of CO_2 Into A Sandstone Reservoir With High Potential For Seepage From Point-Sources And Consequent Monitoring

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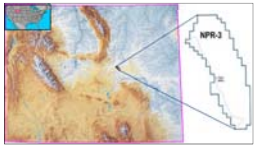
Purpose

Select two reservoirs at Teapot Dome oilfield for a potential shallow CO_2 injection experiment and estimate the volume of CO_2 needed to conduct each leakage experiment.

Location

ROCKY MOUNTAIN OILFIELD TESTING CENTER (RMOTC)

- Department of Energy facility
- Naval Petroleum Reserve No. 3
- Located north of Casper, WY.
- Actively Producing Oilfield
- **Field experimental facility**

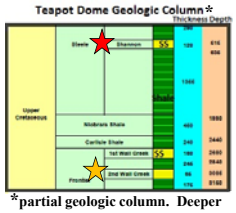


Geology

- Asymmetrical anticline
- Marine shales to coastal sandstones
- Active oil field – 600 wells accessible

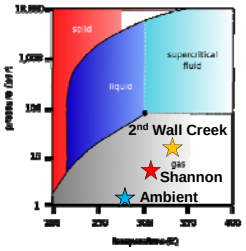
- Deep: Low leak potential
- Shallow: Greater leak potential
  - Leakage prediction, monitoring, and mitigation

2 reservoirs chosen:
Shannon Sandstone and 2nd Wall Creek Sandstone



*partial geologic column. Deeper oil and gas reservoirs extend down to ~5500 feet.

CO_2 Behavior & Calculations



- **CO_2 will remain in the gas phase in both reservoirs**
- Experiment would require a small volume of CO_2

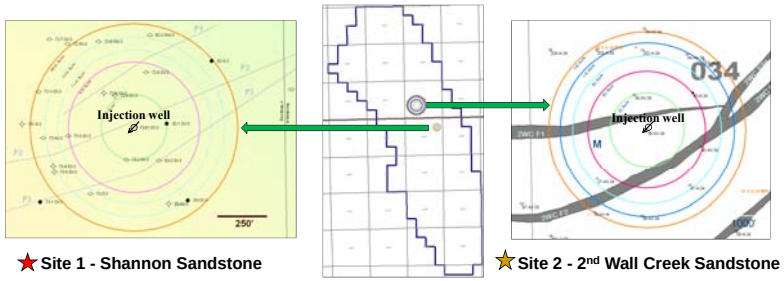
How much CO_2 do we need?

$$G_{CO_2} = A\, h_n\, \phi\, (1-S_w)\, B\, \rho\, E$$

G_{CO2}: Mass CO_2 resource	**Sw**: Water saturation
A: Area	**B**: Volume factor
Hn: Height	**ρ :** Density of CO_2
ϕ : Porosity	**E**: Storage efficiency factor

Reference: Carbon Sequestration Atlas U.S. and Canada (NETL) 2008

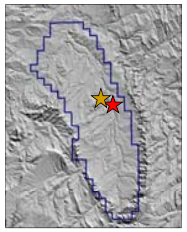
2 Possible Injection Locations



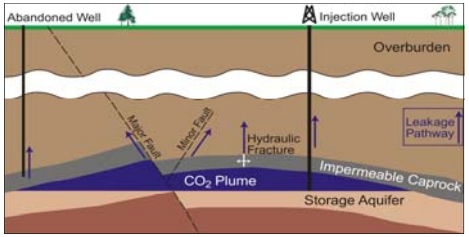
★ **Site 1 - Shannon Sandstone**

★ **Site 2 - 2nd Wall Creek Sandstone**

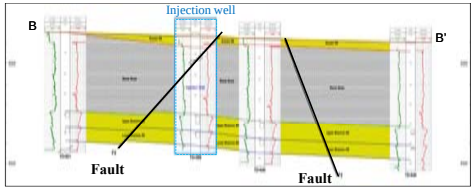
Leakage Pathways



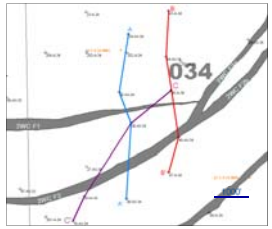
★ Site 1 - Shannon Sandstone

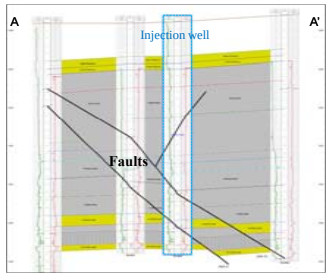


(Courtesy of A. Lucier)



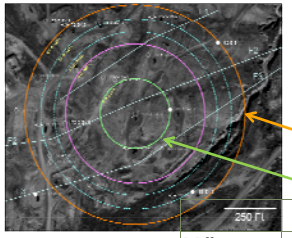
★ Site 2 - 2nd Wall Creek Sandstone





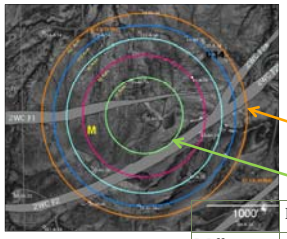
Conclusions

1. **RMOTC is a suitable location for a CO_2 leakage test**
2. **Both Shannon and 2nd Wall Creek are good candidates for possible CO_2 leakage experiment. (Deeper RMOTC reservoirs were not considered for this study)**
3. **Approximately 2-3 trucks (40-60 tons) of CO_2 would be required**



Shannon Sandstone ★
- Maximum 20 Acre study area
- 20 possible leakage conduits
  - 17 wells and 3 faults
- 28.23 tons of CO_2 required

	Min Area (2 Acre)	Max Area (20 Acre)
Wells	2	17
Faults	1	3
G_{CO2} (tons)	7.66	**28.23**



2nd Wall Creek ★
- Maximum 140 Acre study area
- 15 possible leakage conduits
  - 13 wells and 2 faults
- 57.69 tons of CO_2 required

	Min Area (20 Acre)	Max Area (140 Acre)
Wells	1	13
Faults	1	2
G_{CO2} (tons)	5.99	**57.69**

Future work:
- Would depend on goals of testing partners
  - Evaluate cement bond logs
  - Geomechanical assessment
  - Add baseline gas-flux and geochemical data
  - Reservoir modeling
  - More detailed risk assessment

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