PLAINS CO_2 REDUCTION (PCOR) PARTNERSHIP UPDATE

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Energy & Environmental Research Center

2017 Midwest Carbon Sequestration Science Conference Annual Meeting
September 19–20, 2017

Critical Challenges. Practical Solutions.

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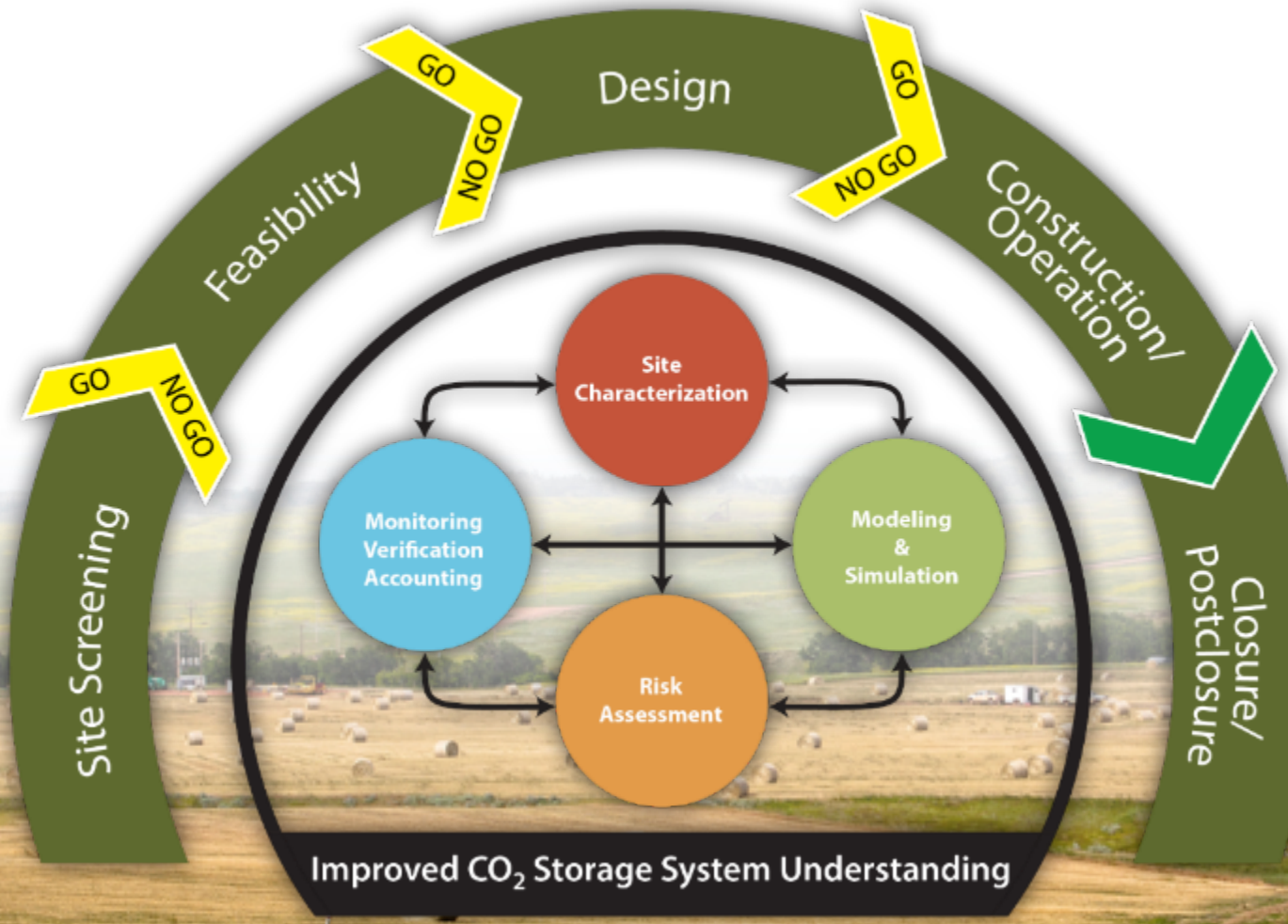
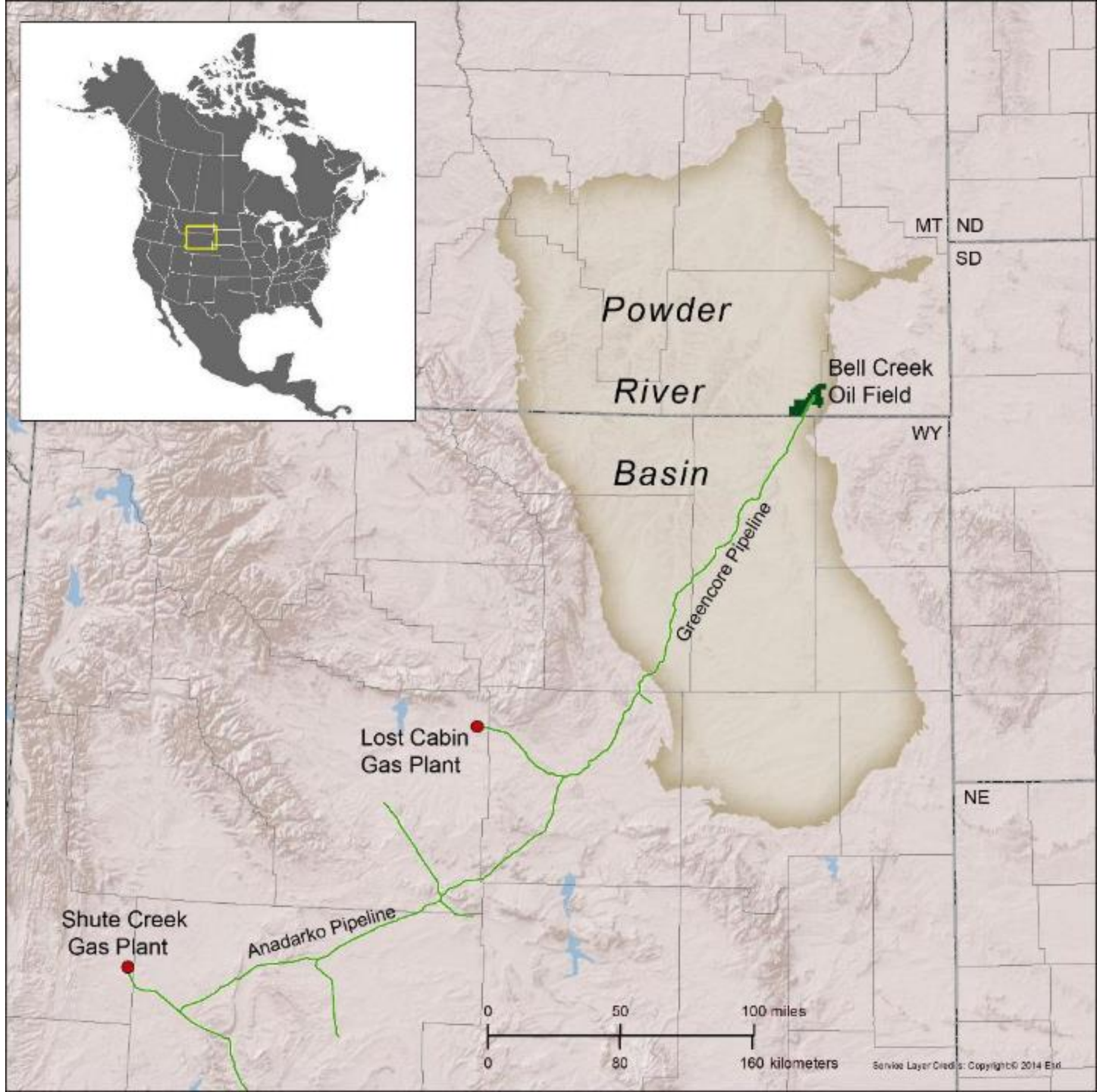
ADAPTIVE MANAGEMENT APPROACH



BELL CREEK

- The Bell Creek oil field is operated by Denbury Onshore LLC.
- CO_2 is sourced from ConocoPhillips' Lost Cabin and ExxonMobil's Shute Creek gas-processing plants.
- The Energy & Environmental Research Center is studying CO_2 storage associated with commercial CO_2 enhanced oil recovery (EOR).

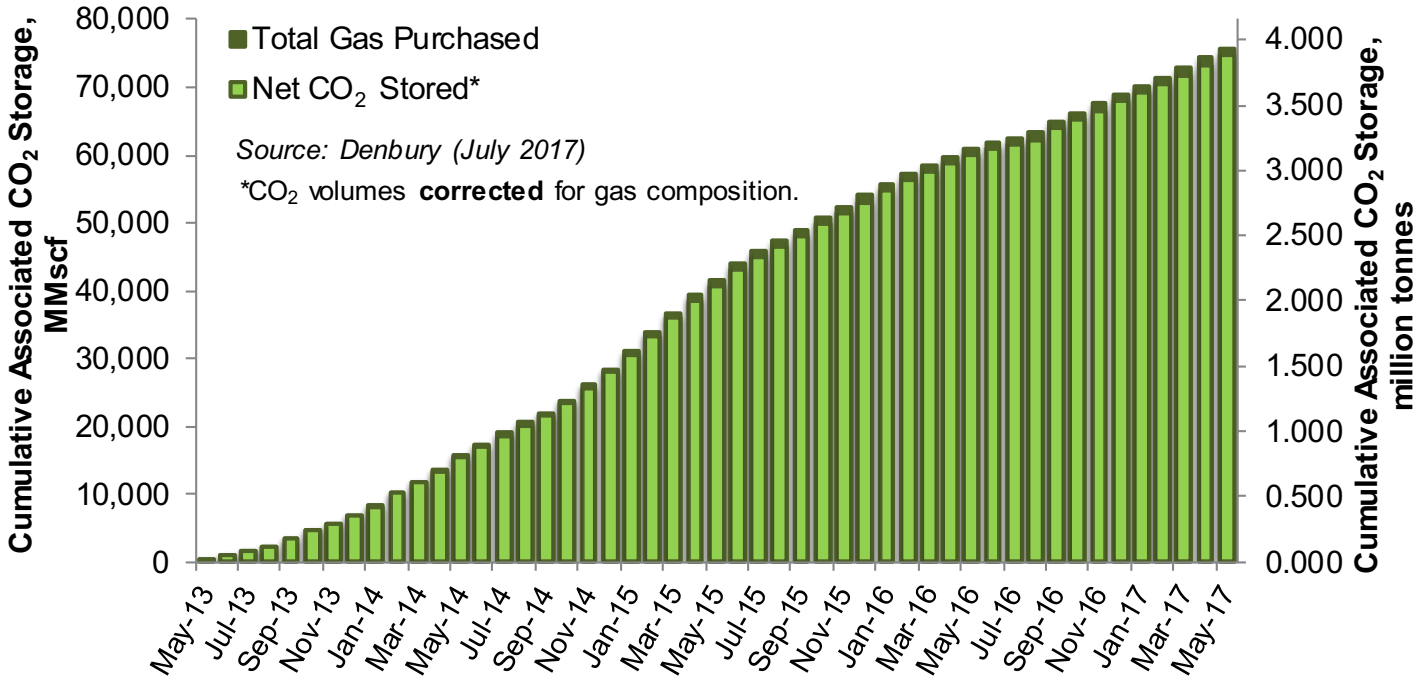


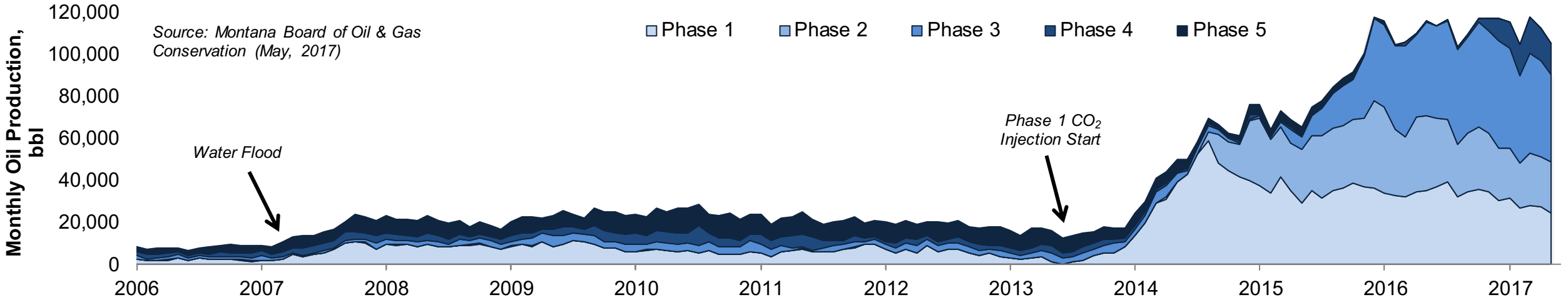
EERC | U.S. DEPARTMENT OF ENERGY | NATIONAL ENERGY TECHNOLOGY LABORATORY | PCOR Partnership

CO_2 INJECTION

As of May 2017

- Oil Produced: ~3.9 million barrels
(source: Montana Board of Oil & Gas [MBOG] database)
- CO_2 Stored: ~3.9 million tonnes
(source: Denbury)



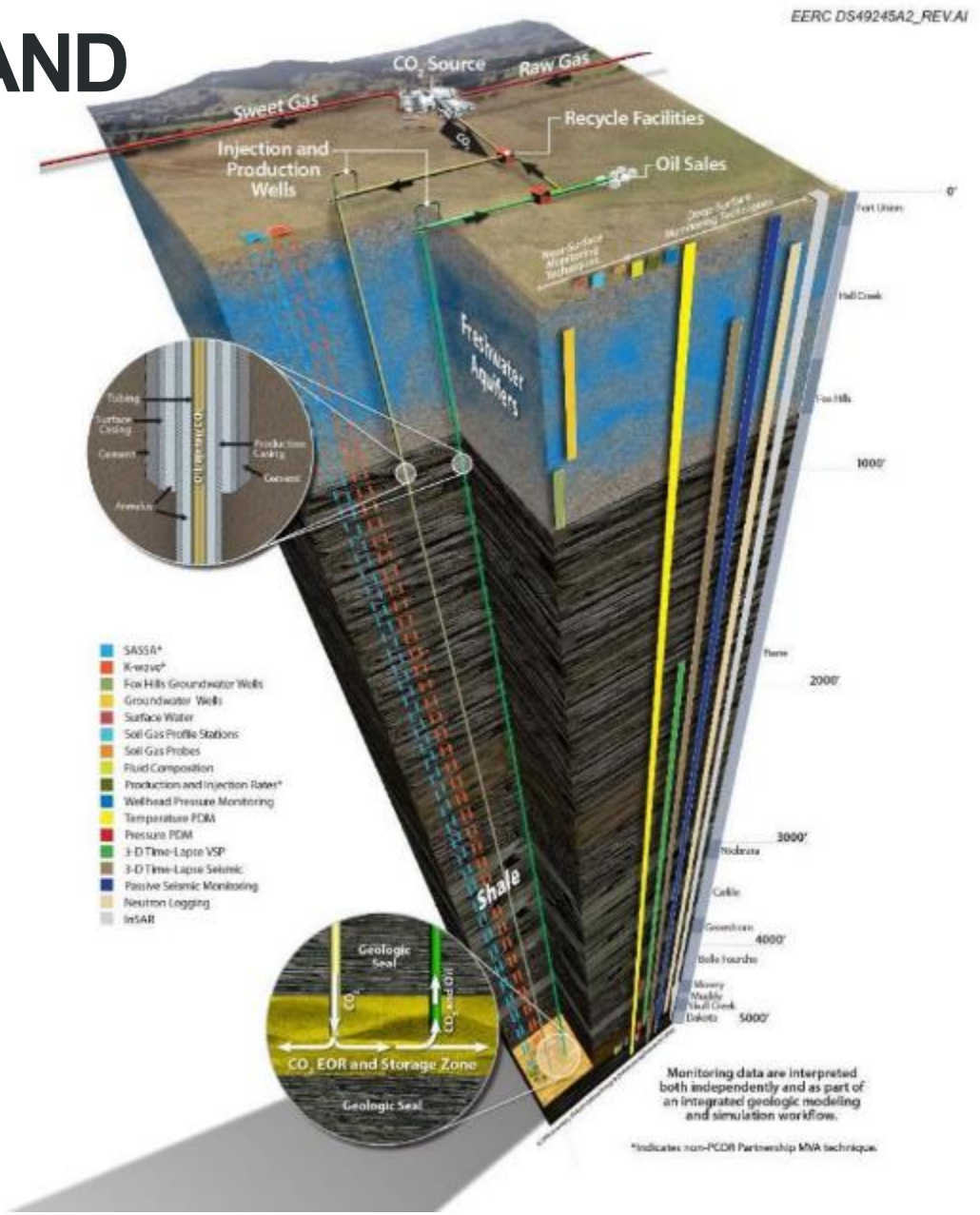


MONITORING, VERIFICATION, AND ACCOUNTING (MVA)

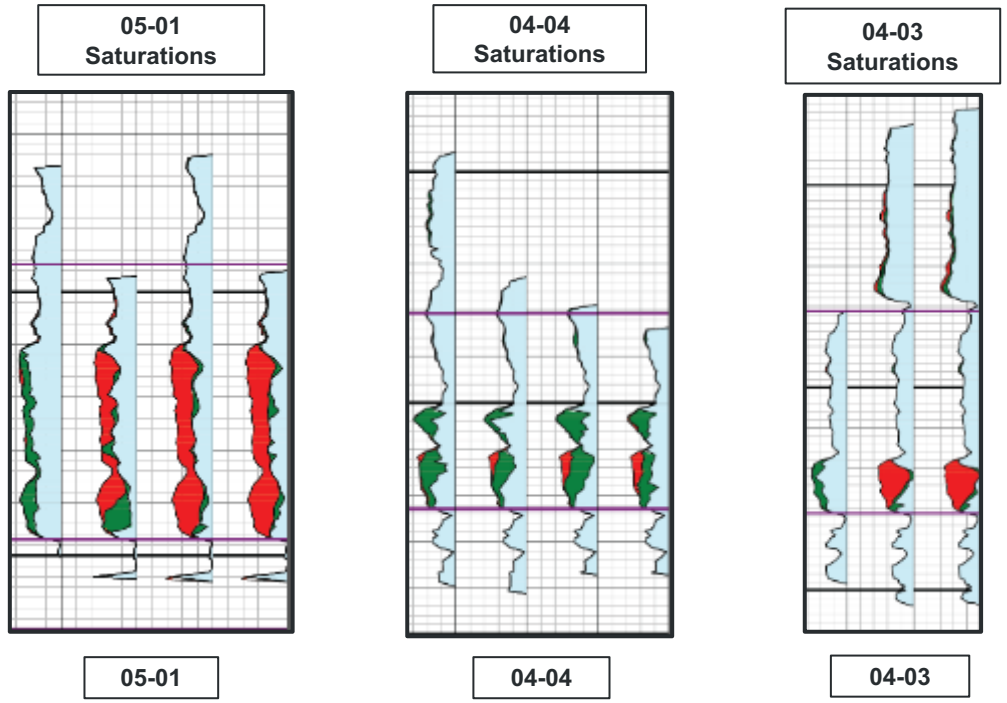
- 16 techniques
- 1.5 years of preinjection monitoring
- 3+ years of operational monitoring

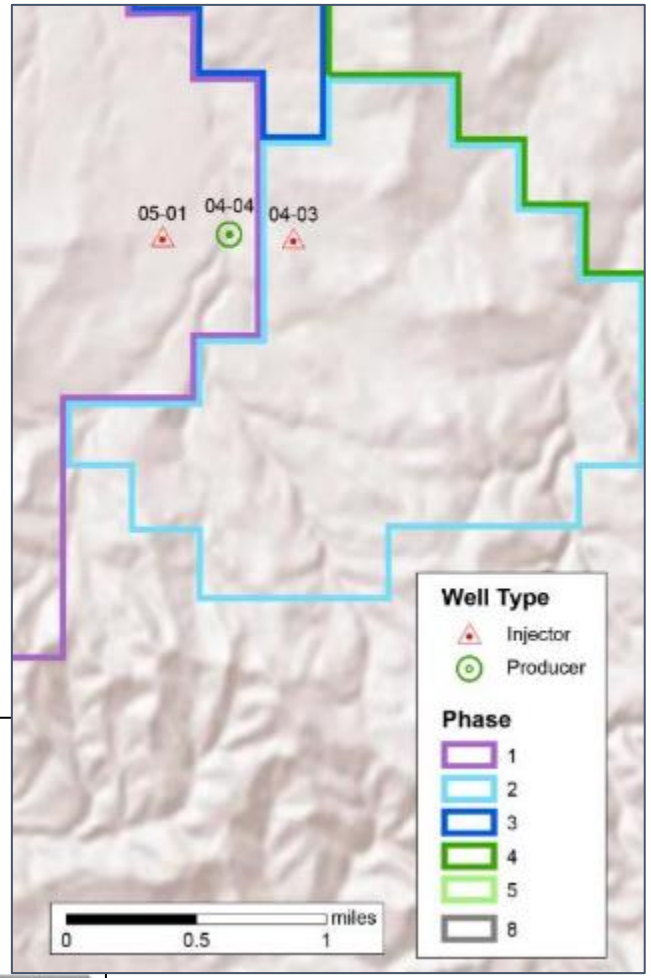
Demonstrate and validate monitoring techniques and their associated economics to inform viable MVA strategies for commercial-scale carbon capture and storage (CCS).

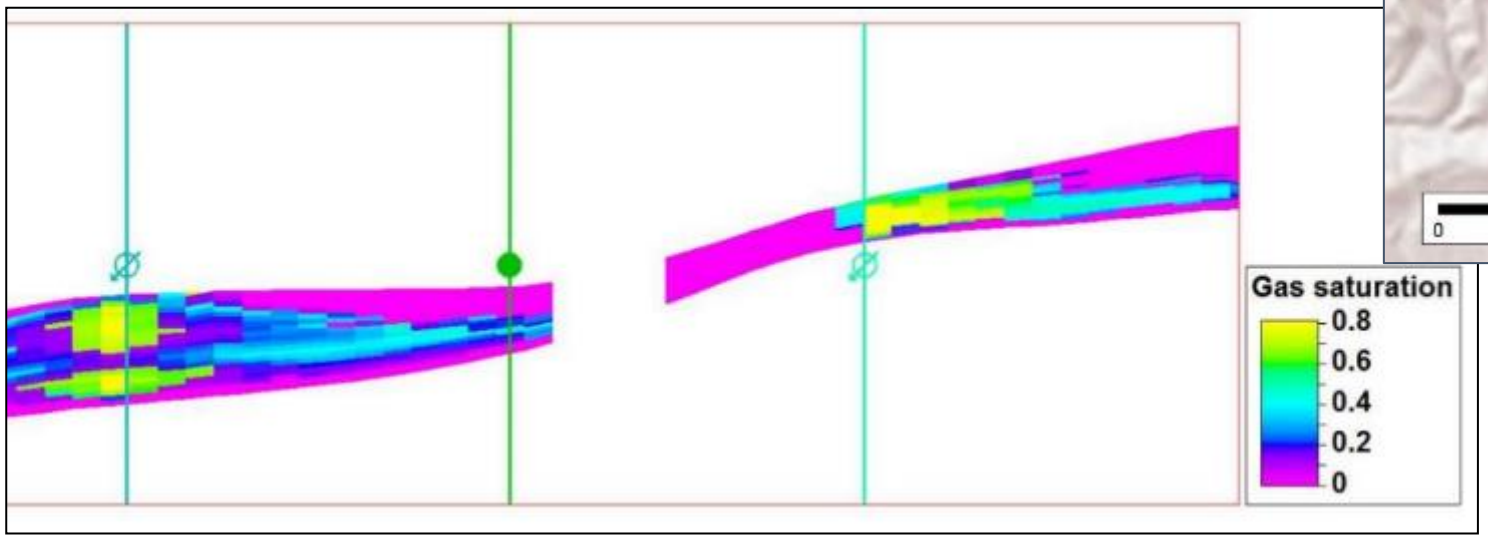
Building off of the backbone of commercial operations data.



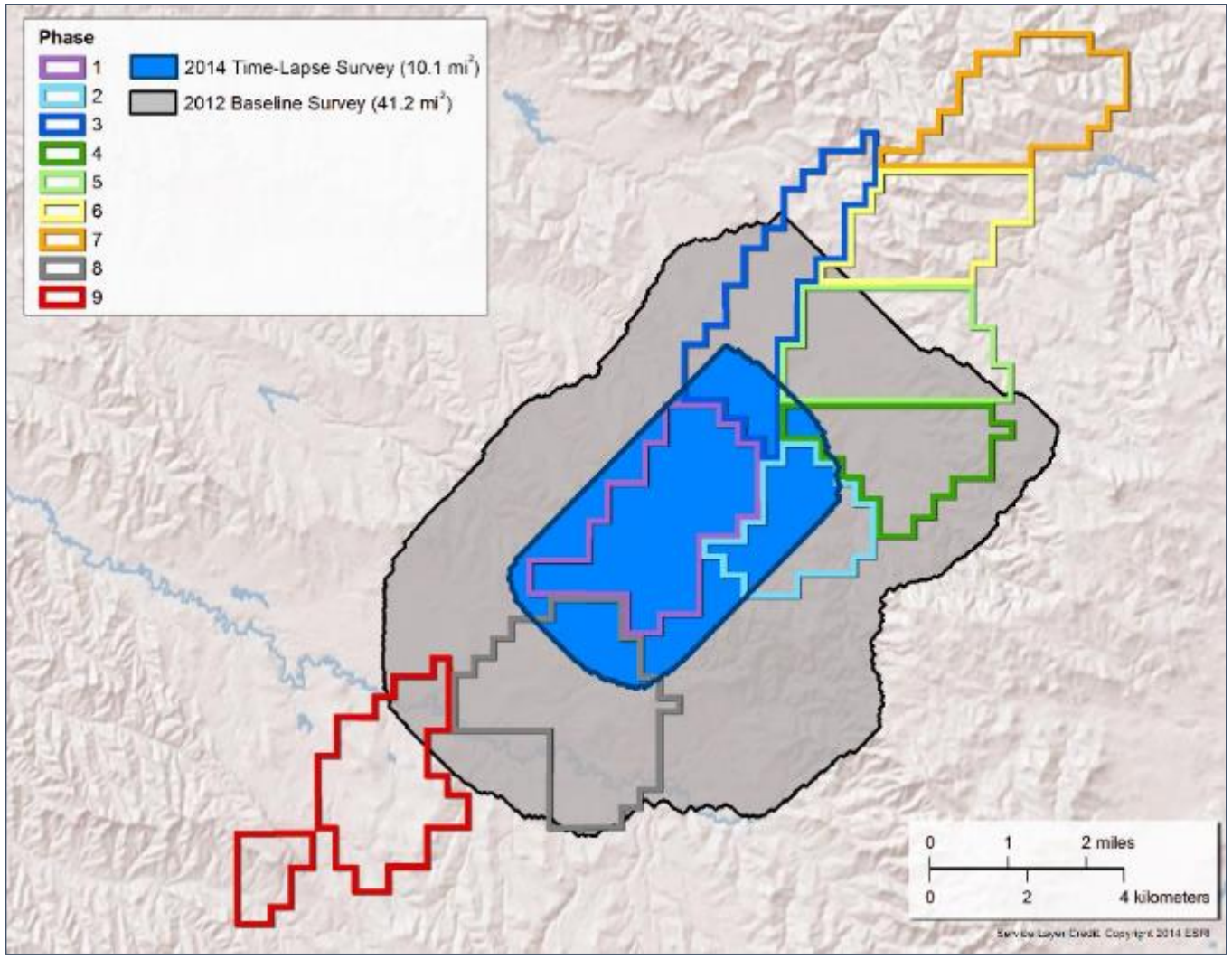
MVA FOR MODEL VALIDATION – PULSED-NEUTRON LOGGING







FIRST REPEAT 3-D SURVEY

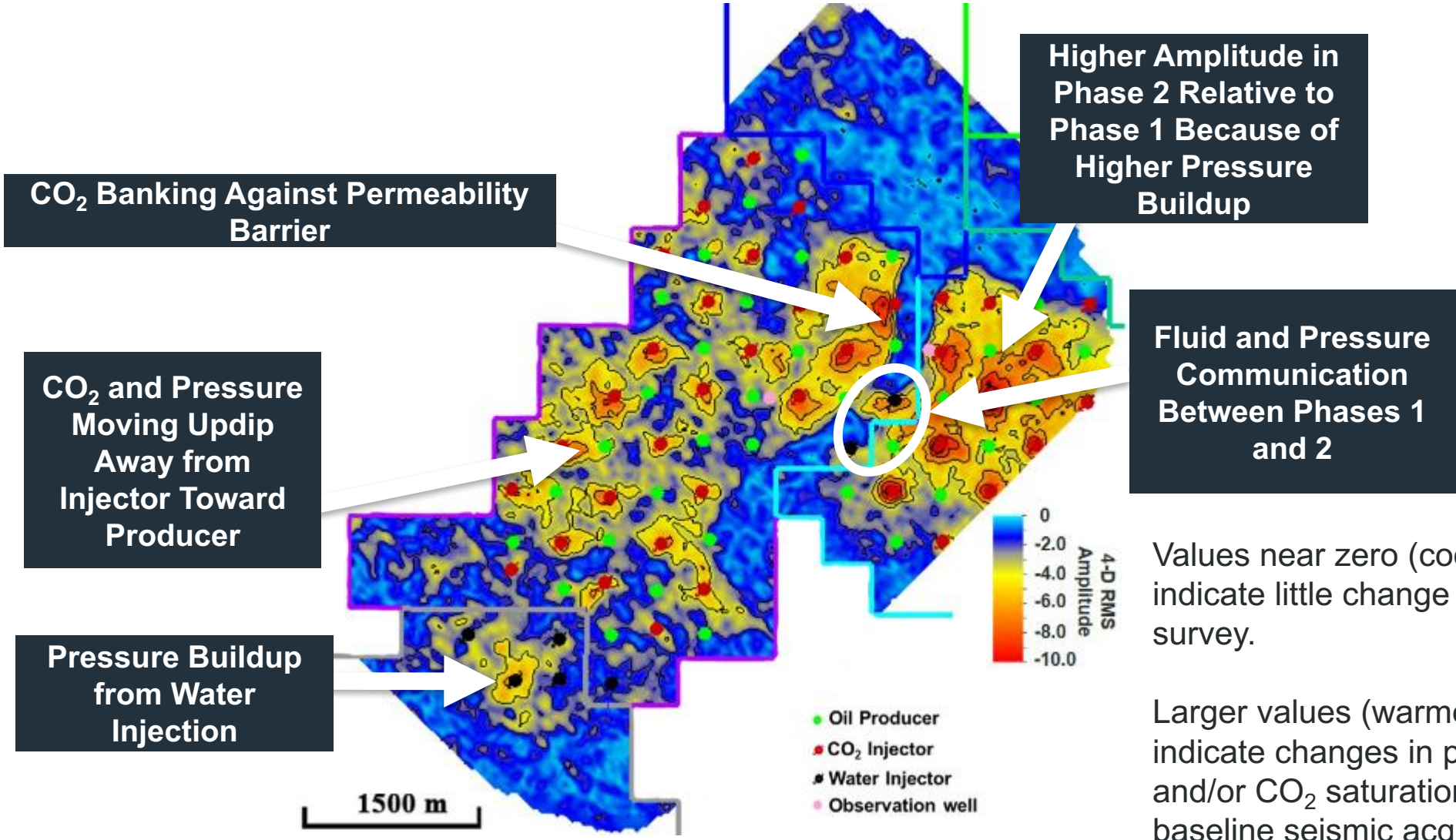


Phase	Start of CO_2 Injection	Estimated Associated CO_2 Storage (Oct 2014), Mt
1	May 2013	1.04
2	Dec 2013	.166

Calculated using MBOG data.

- 26-km^2 repeat (October 2014).
- ~1.2 Mt CO_2 stored in monitored area at the time of survey.

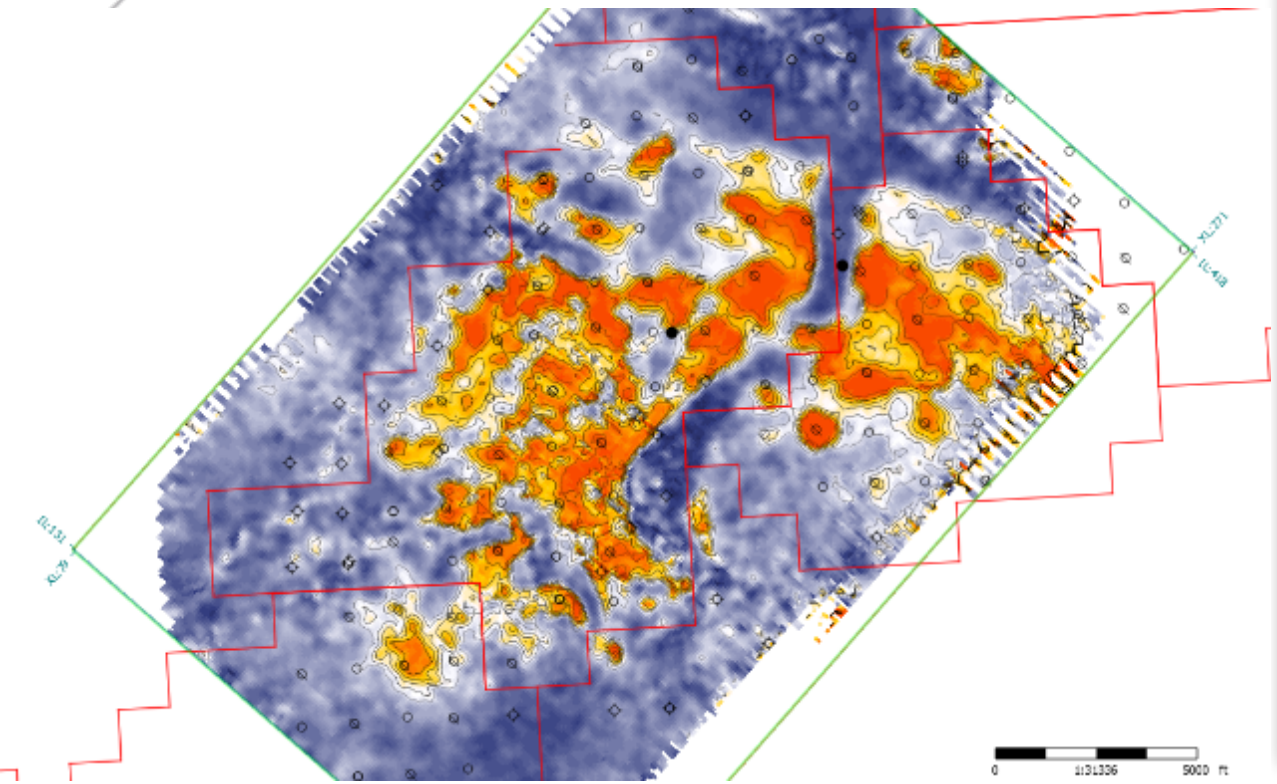
FIRST REPEAT 4-D DIFFERENCE INTERPRETATION (2012–2014)

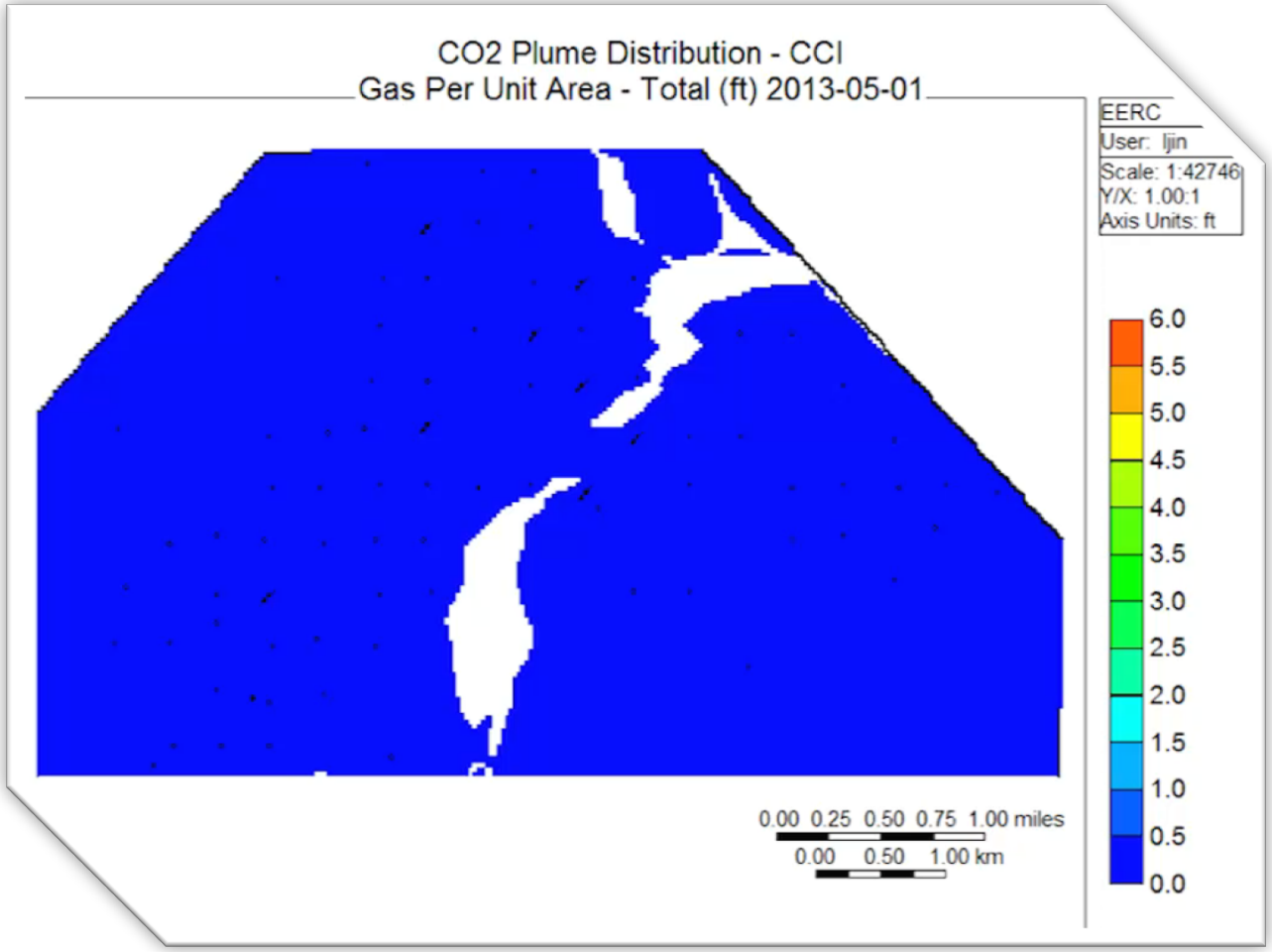


Values near zero (cooler colors) indicate little change from baseline survey.

Larger values (warmer colors) indicate changes in pressure and/or CO_2 saturation since baseline seismic acquisition.

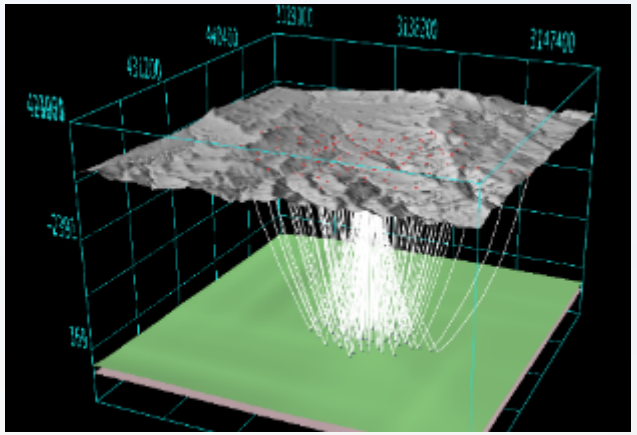
COMPARING OBSERVATIONS WITH PREDICTIONS

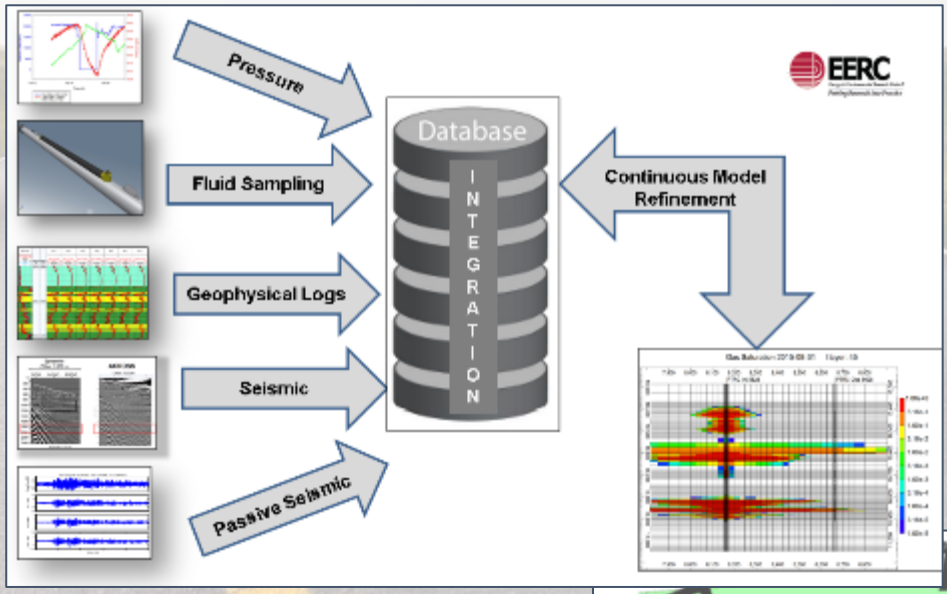


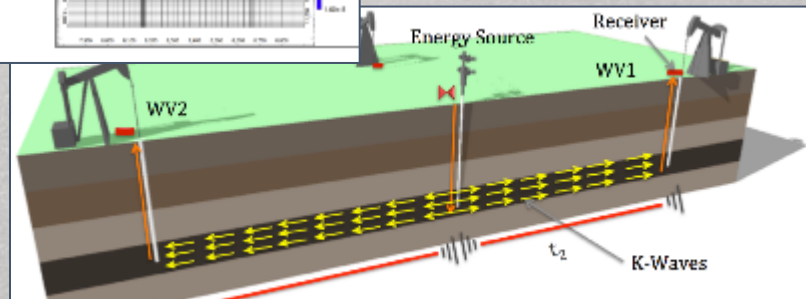


FUTURE OF MONITORING

- Integrated
  - Improve performance forecasts
  - Inform operational decisions
  - Address risks
- Actionable results
- No impact on operations
- Low environmental impact
- Focus on fast processing
- Semiautonomous
- Scalable
- Efficient and strategic acquisitions
- Cost-efficient/enhanced value
- Intelligent monitoring
- Key indicators vs. robust solutions







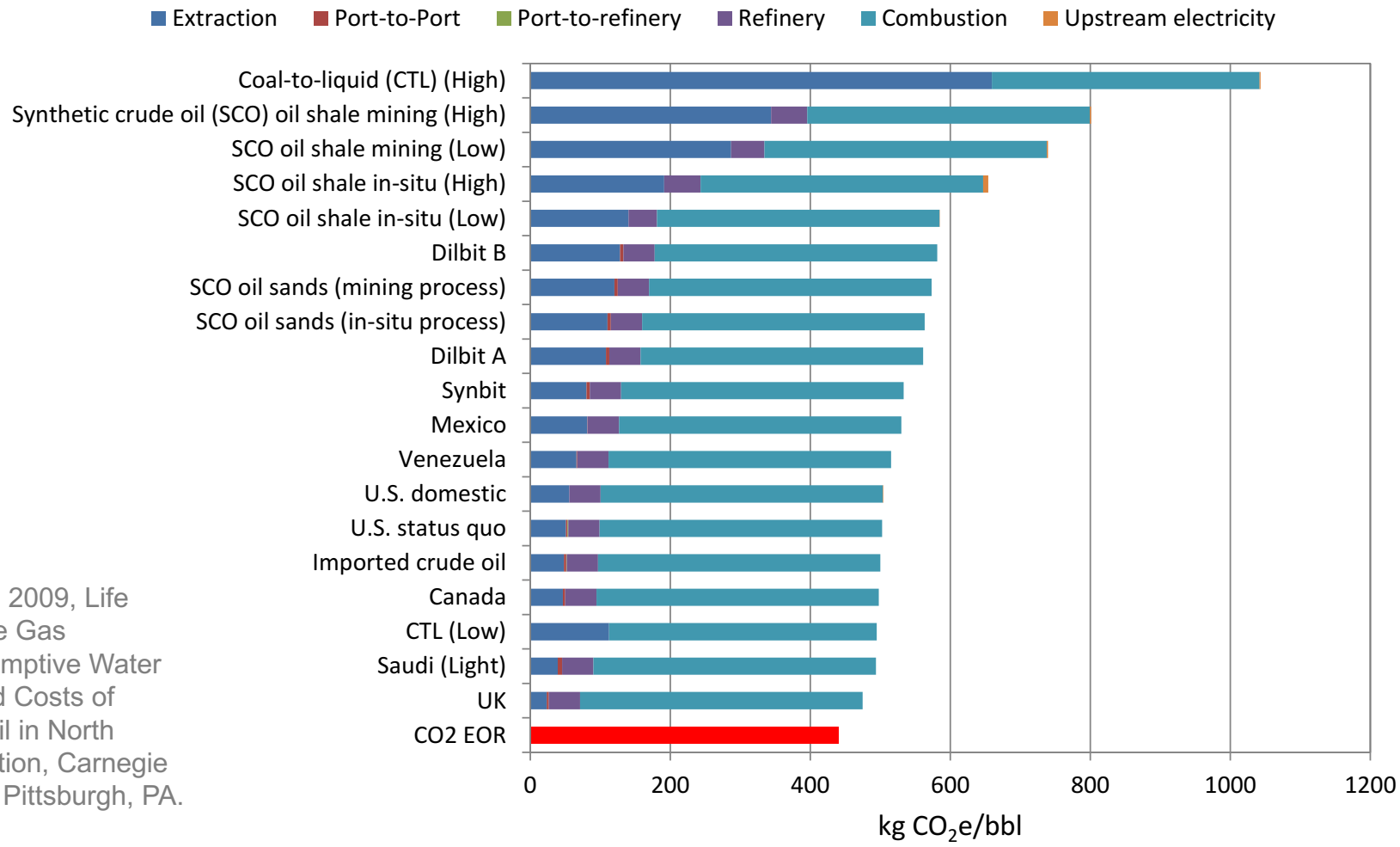
CO_2 EOR

- **A great near-term storage option:**
- Over 40 years of handling and injecting large volumes of CO_2.
- Much of the infrastructure already in place.
- Storage cost can be offset by income from EOR.

"Greener" than conventionally produced oil:

- Existing EOR operations are already storing CO_2.
- Nearly every tonne of CO_2 purchased is eventually stored.

COMPARING CO_2 EOR TO "REGULAR" OIL



Adapted from:
Mangmeechai, A., 2009, Life Cycle Greenhouse Gas Emissions, Consumptive Water Use and Levelized Costs of Unconventional Oil in North America: Dissertation, Carnegie Mellon University, Pittsburgh, PA.

JOURNAL ARTICLE

International Journal of Greenhouse Gas Control 51 (2016) 369–379

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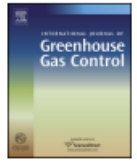

How green is my oil? A detailed look at greenhouse gas accounting for CO_2-enhanced oil recovery (CO_2-EOR) sites

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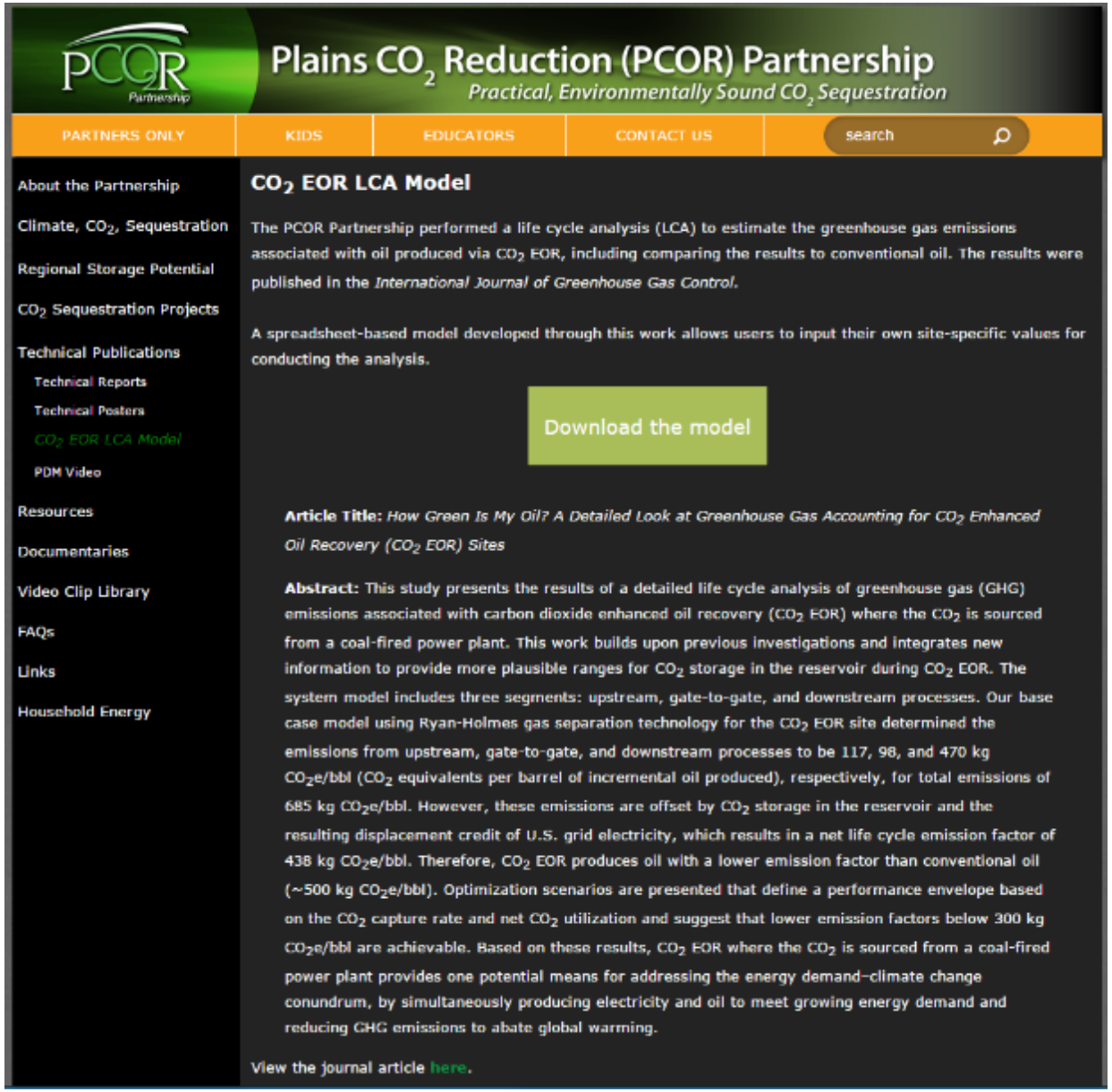
http://www.sciencedirect.com/science/article/pii/S1750583616302985

The spreadsheet CO_2 EOR life cycle analysis model is available on the PCOR Partnership public Web site!



http://www.undeerc.org/pcor/technicalpublications/CO2-EOR-Life-Cycle-Analysis.aspx

INTEGRATED CCS FOR NORTH DAKOTA ETHANOL PRODUCTION – RED TRAIL ENERGY

- Evolving ethanol markets are opening new opportunities.

- Objectives:
  - Determine technical and economic feasibility for ethanol CCS
  - Provide a preliminary implementation plan

Photographs by OpenSource.com and Ishikawa Ken,

Red Trail Energy

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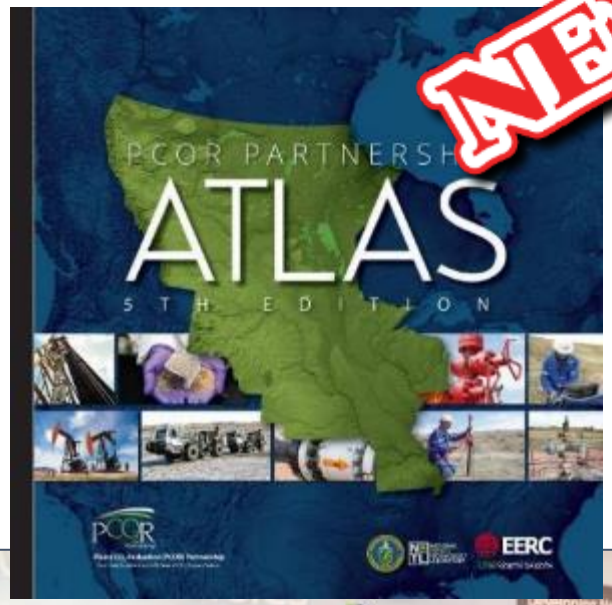
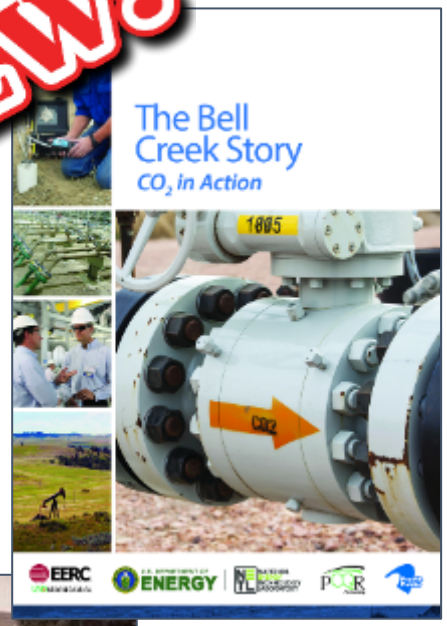
OUTREACH IS KEY



NEW!



COMING SOON!

- Documentary:
  - Coal Powered! (*working title*)

Thank you for your kind attention!

Questions?

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