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Plains CO₂ Reduction (PCOR) Partnership CCS Demonstrations

**European CCS Project Network
Knowledge-Sharing Meeting
Brindisi, Italy**

February 16, 2011

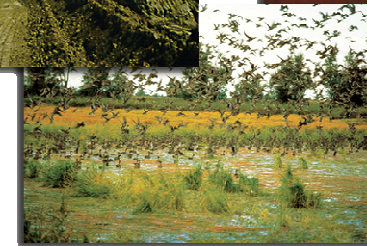
Ed Steadman



U.S. Department of Energy Regional Carbon Sequestration Partnerships (RCSPs)



Project Overview: The PCOR Partnership Region



Project Overview: The PCOR Partnership Region (continued)

CO₂ PRODUCTION BY SOURCE

Percent of Total CO₂

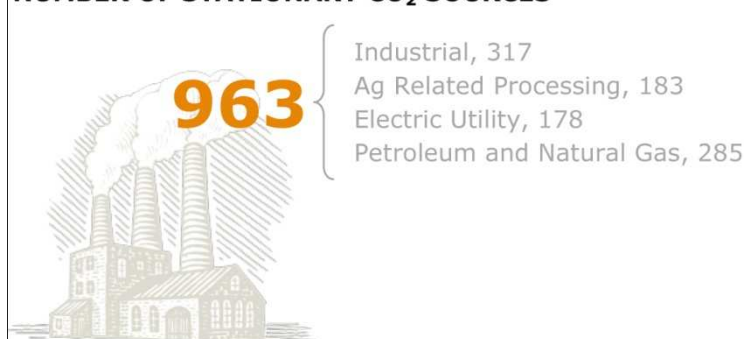


AREA

Million Square Kilometers



NUMBER OF STATIONARY CO₂ SOURCES

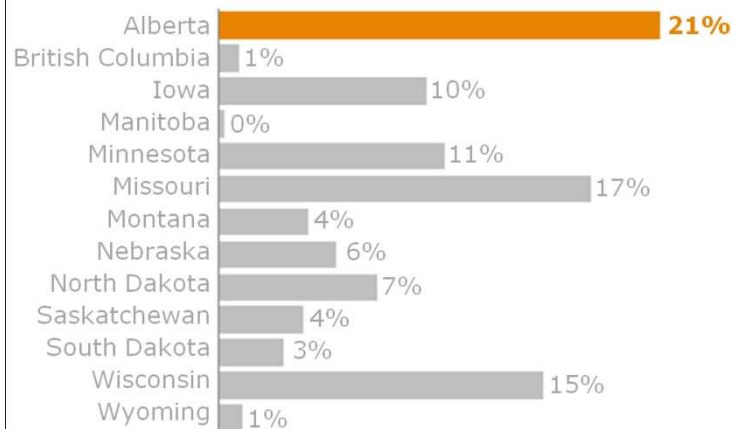


POPULATION



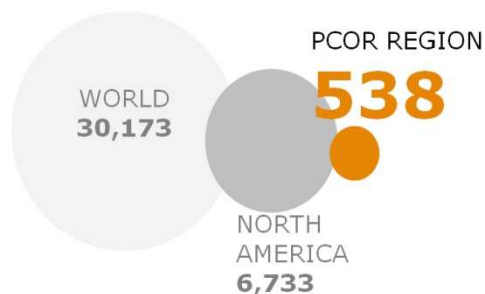
CO₂ PRODUCTION BY STATE/PROVINCE

Million Tonnes per Year



CO₂ PRODUCTION

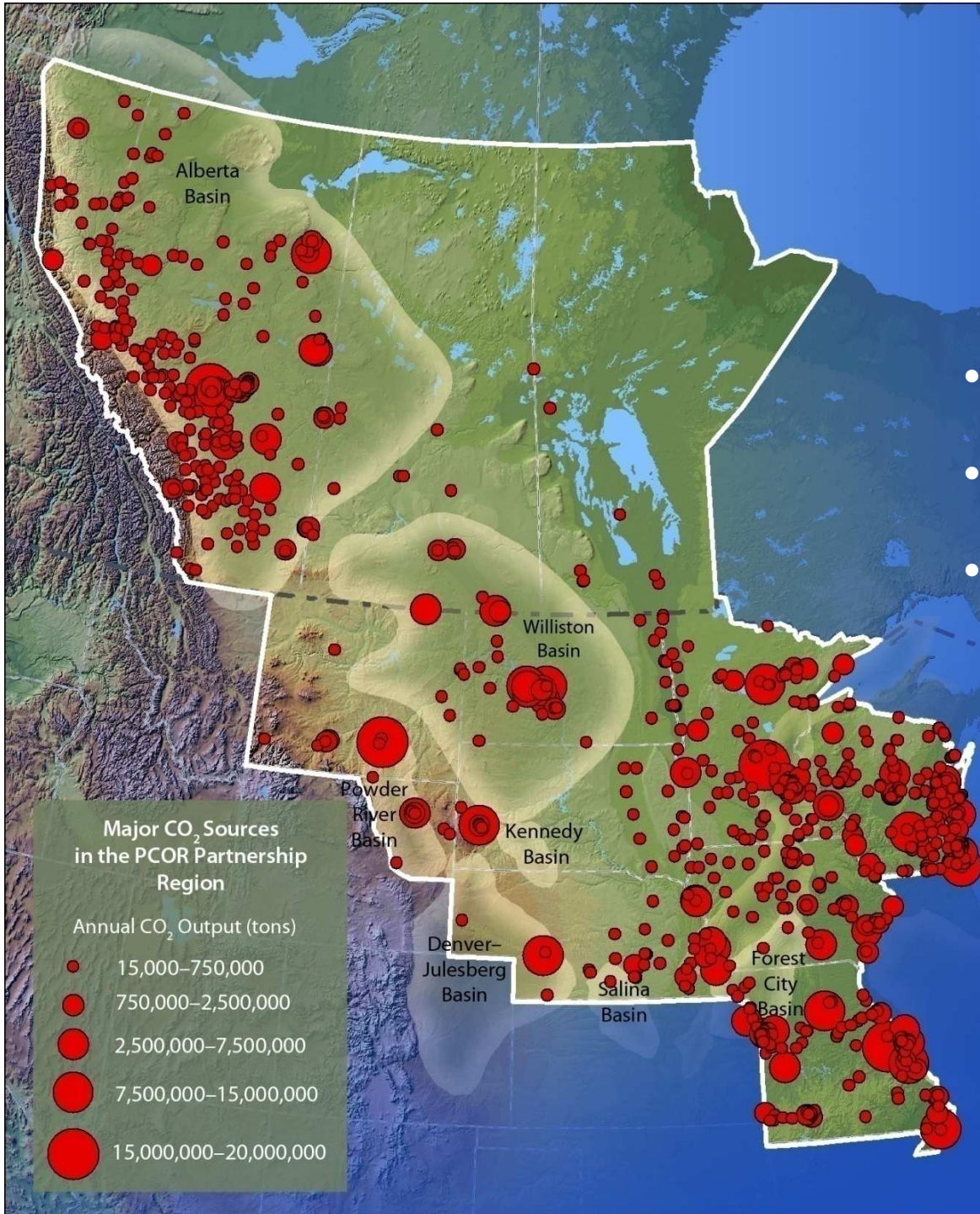
Million Tonnes per Year



ENERGY USE

Trillion Btu per Year



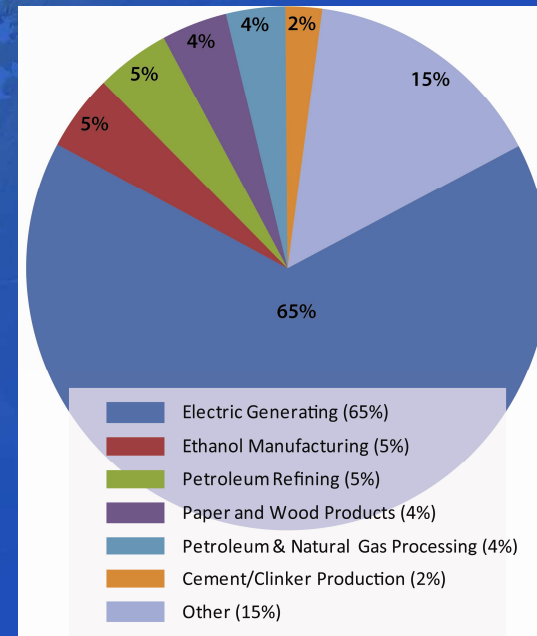


Sources

927 stationary sources

Total CO₂ emissions:
≈ 510 million tonnes/yr

- 9% of U.S. and Canada population
- 8% of U.S. and Canada gross domestic product (GDP)
- 12% of U.S. and Canada anthropogenic CO₂



Field Validation Tests



Key Results

- Unminable lignite may represent CO₂ sequestration targets in the PCOR Partnership region, but more research needs to be done prior to large-scale demonstration and commercialization.
- Early exploration efforts do not support commercially viable coalbed methane potential in North Dakota lignite seams.



Key Results (continued)

- The pinnacle reef structures employed in the Zama project represent significant opportunities for both enhanced oil recovery (EOR) and CO₂ storage.
- Monitoring, verification, and accounting (MVA) programs can be developed that are unobtrusive to commercial operations and are both technically sound and cost-effective.



Apache
CANADALTD.

Key Results (continued)

- Small-scale (huff 'n' puff-type) CO₂ injection into deep carbonate systems is technically feasible and has the potential to result in commercially viable EOR operations in the future.
- Tertiary-phase EOR is the primary near-term opportunity for managing CO₂ in the PCOR Partnership region.



Key Results (continued)

- EOR demand for CO₂ exceeds near-term supply.
- Natural gas-processing facilities represent a key near-term source of CO₂.
- If CO₂ supply surpasses EOR demand, saline aquifers are available throughout the region to meet sequestration demand.



Key Results (continued)

Outreach activities are critical to the success of CO₂ storage projects and must be conducted at every level, from local communities to nationwide venues.

- Five documentaries
- Over a dozen fact sheets
- Public Web site with monthly updates
- 65-page regional atlas
- Over 20 technical reports



Key Results (continued)

- Outreach activities are critical to the success of CO₂ storage projects. Outreach activities must be conducted at every level, from local communities to nationwide venues.
- Regulatory and legal issues are constantly changing in this topic area and represent key challenges to CO₂ storage technologies.



Phase III Commercial-Scale Projects



1. Fort Nelson Saline
2. Zama Saline
3. Bell Creek EOR

Fort Nelson Carbon Capture and Storage (CCS) in a Deep Saline Formation

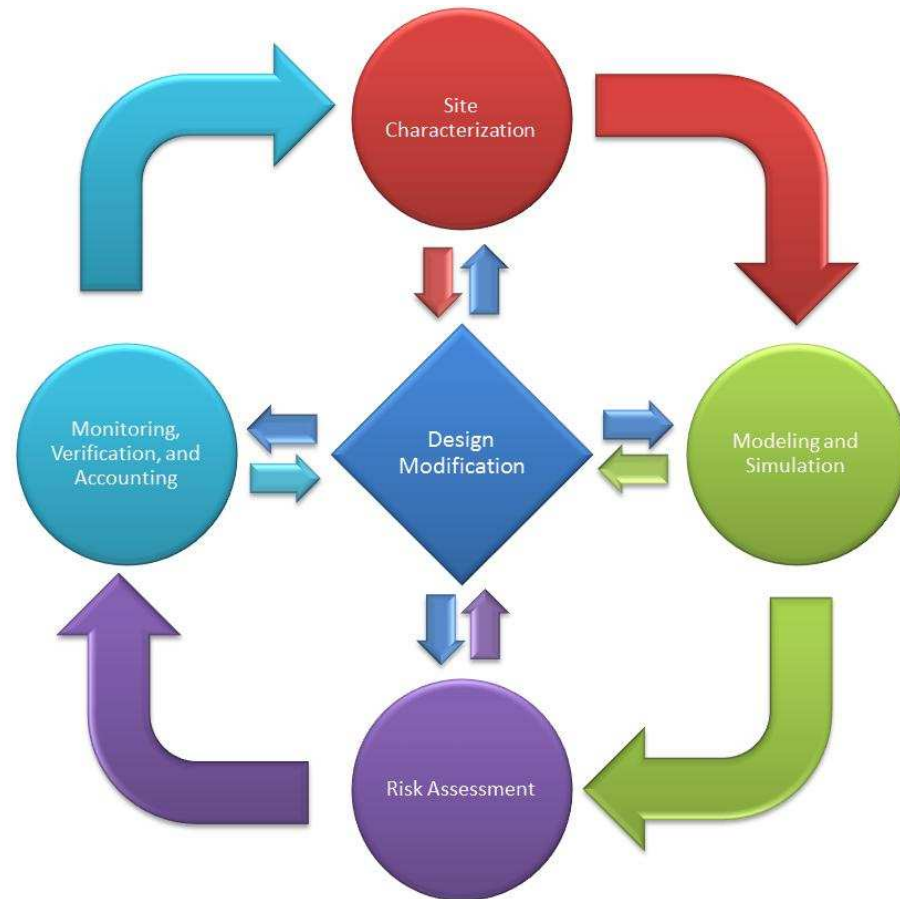


Drill rig and camp site near Fort Nelson, British Columbia, Canada



Fort Nelson

- Risk-based approach to define MVA strategy.
- MVA plan will be cost-effective.
- Minimal disruption of the operations at Fort Nelson.



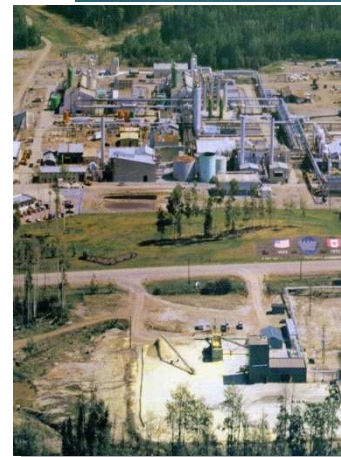
Fort Nelson (continued)

- Saline formations represent the largest single target for CO₂ storage.
- Reconnaissance-level efforts in the PCOR Partnership region have identified over 200 Gt of potential storage.
- The PCOR Partnership region includes many of the largest and most well understood carbonate rocks in the world.
- Phase III results will be broadly applicable throughout the region.



Fort Nelson – Current Status

- An exploration well was drilled spring 2009. The well was reentered, and additional logs were collected in the winter drilling season 2009–2010.
- Additional seismic data may be purchased and collected in the winter field season 2010–2011.
- The PCOR Partnership has provided a risk management plan (RMP) as part of its integrated RMP, modeling, and MVA program.

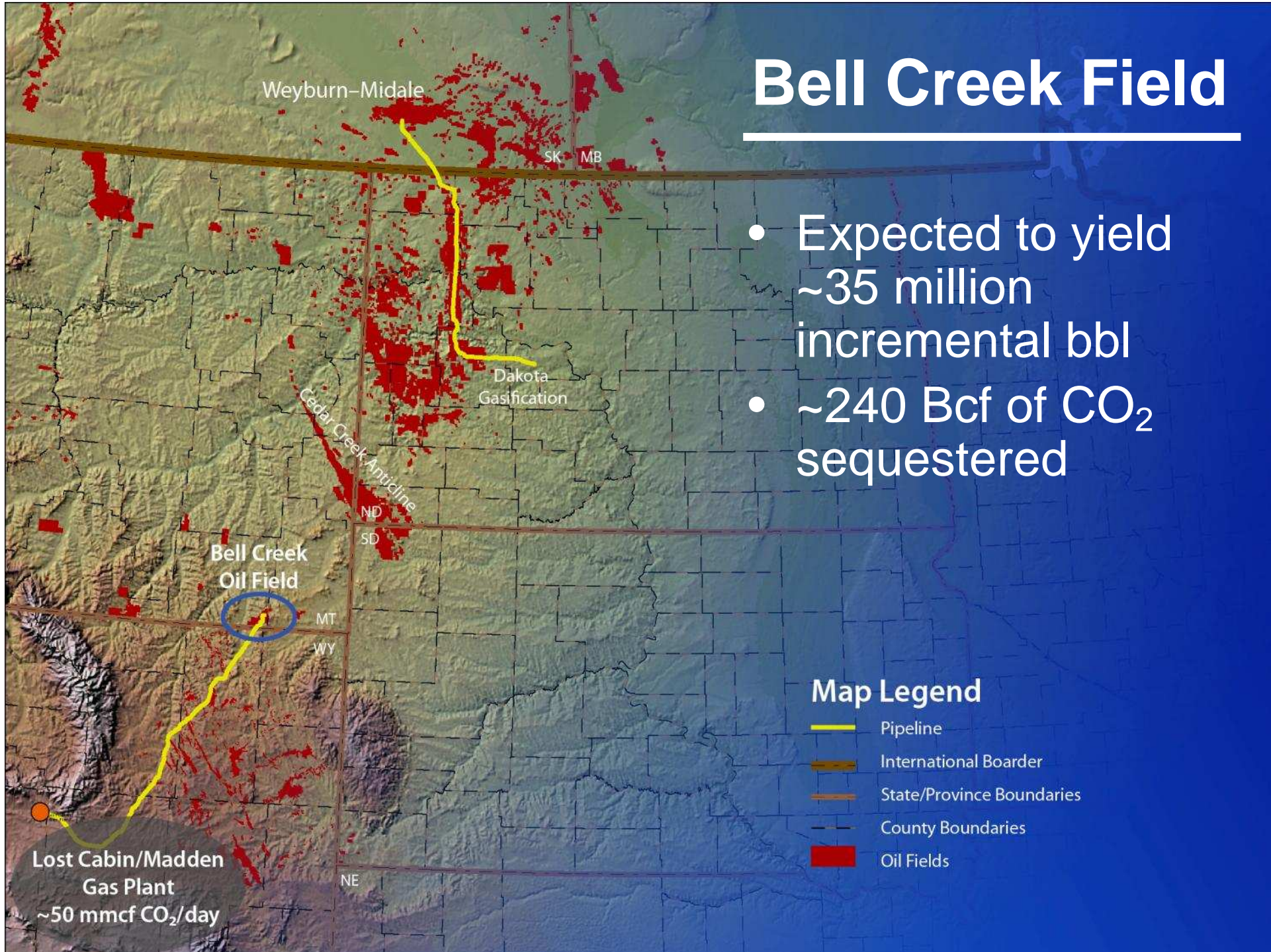


Bell Creek EOR Project



Bell Creek Field

- Expected to yield ~35 million incremental bbl
- ~240 Bcf of CO₂ sequestered



CO₂ Demand

- The PCOR Partnership region has an unmet commercial demand for CO₂ for EOR.
- PCOR Partnership region has approximately 25 Gt of CO₂ capacity through CO₂-based EOR.
- Oil fields may offer the best opportunities to implement large-scale CO₂ storage.



Bell Creek

- Will store 14 million tonnes of CO₂.
- Will produce an estimated 30+ million barrels of incremental oil worth an estimated \$2.7 billion.



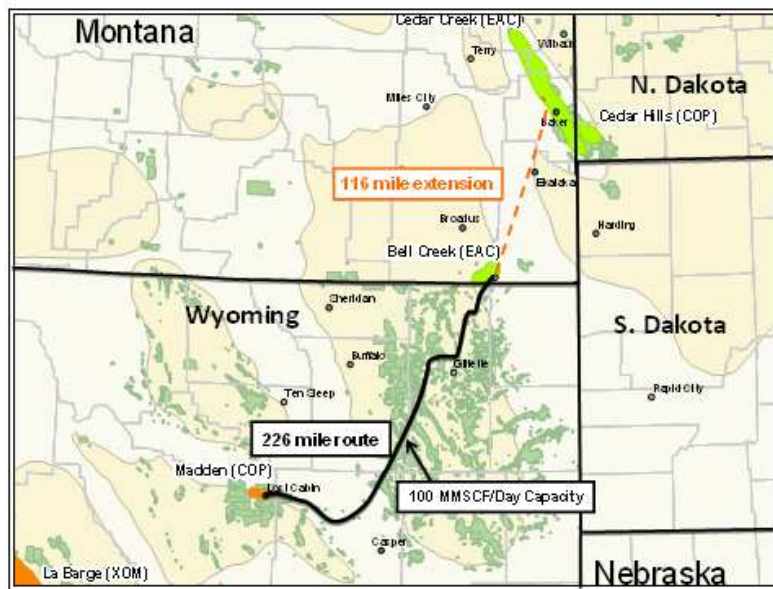
Bell Creek (continued)

Formation	Depth, m	Thickness, m	Temp., °C	Range of Permeability, mD	Salinity, ppm	Porosity, %
Muddy	1370	6–10	42	500–1200	6400–7400	24

- Porosity and permeability data suggest that injectivity will be more than adequate to support long-term and large-scale CO₂ injection.

PCOR Partnership Status

We are moving ahead with both the Bell Creek and the Fort Nelson demonstrations.



PCOR Partnership Outreach Support

- 65-page regional sequestration atlas
- Fact sheets on key topics and projects
- A variety of PowerPoint presentations
- Public Web site with streaming and downloadable materials
- Sequestration documentaries (television broadcasts, Web streaming, and DVDs)
- Video clips
- Technical reports





PCOR Partnership 2003 – Present													

Conclusion



The PCOR
Partnership region
has huge CCS
potential!



Thank You for Your Kind Attention!



Ed Steadman
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Talking Points

What the PCOR Partnership would like to share with you:

- The PCOR Partnership region has huge CCS potential.
- Tertiary-phase EOR is the primary near-term opportunity for managing CO₂ in the PCOR Partnership region.
- If CO₂ supply surpasses EOR demand, saline aquifers are available throughout the region to meet sequestration demand.
- MVA programs can be developed that are unobtrusive to commercial operations and are both technically viable and commercially sustainable.

In discussions with the audience, I hope to gain knowledge of the following:

- Updates on other CCS projects and lessons learned.
- Regulatory issues, e.g., pore space ownership, liability, permitting, for other CCS projects.