Director’s Update
Enhanced Oil Recovery Institute
2013 CO2 Conference
July 10 & 11, Casper, Wyoming

BY THE WYOMING ENHANCED OIL RECOVERY INSTITUTE (EORI)
Wyoming Then and Now

Salt Creek Wyoming, 1910-1930
Courtesy of: UW American Heritage Center
Wyoming Oilfield Photography Collections:

Pinedale Anticline 2012
Courtesy of National Geographic Magazine

University of Wyoming
Disclaimer and Acknowledgements

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  Glen Murrell, EORI
  Steve Melzer – Melzer Consulting
  Ben Cook, University of Wyoming
Update EORI Work – 2012-2013

• Continue Minnelusa Consortium work
  – Optimize and expand waterfloods
  – Utilize geophysics for exploitation
  – Evaluate application of EOR

• Continue Tensleep Work Shop Program
  – Optimize flood performance
  – Evaluate potential for EOR
  – Characterize Main Pay Zones (MPZs) and Residual Oil Zones (ROZs)
  – Better Characterize Natural Fracturing

• Initiate a Tensleep Consortium

• Continue support of IOR and EOR implementation with small Wyoming operators
Highlighted Events during the Past Year

- CO2 injection into the Grieve Field was initiated by Denbury early in 2013.
- Beaver Creek Madison CO2 EOR production exceeds 4000 BOPD.
- EORI has supported the Wyoming Pipeline Authority with definition of right-of-ways for utilities including CO2 transportation lines.
- Multiple new CO2 floods are being evaluated for implementation within the state.
EORI Resources and Expertise

- Reservoir Characterization – Peigui Yin
- Lab Studies – Sheena Xie
- Reservoir Simulation – Shaochang Wo
- Project & Program Economics – Glen Murrell & Ben Cooke
Reservoir Characterization

• Evaluate reservoir rocks and fluids
  – Cores
  – Geophysical logs
  – Cuttings
  – Other

• Develop geologic models
The EORI lab provides the capability to screen and validate EOR methods and to increase oil recovery in Wyoming. The EORI lab can provide a wide range of laboratory measurements to support Wyoming IOR and EOR projects. When commissioning of the new lab equipment is completed, the EORI lab may perform most EOR tests at reservoir conditions.
State-of-the-Art Laboratory Equipment

- Three core flood lines with capability to complete core work at high P and T.
- Phase behavior system to measure bubble and dew point pressures and perform swelling tests.
- Slim tube apparatus to measure minimum miscibility pressure.
- GOR apparatus to test GOR (GWR) for reservoir fluids.
- GCs for oil and gas compositional analysis.
- Pendent drop tensiometer for IFT measurements.
State-of-the-Art Laboratory Equipment

• Visual cell for observation of fluid behavior.
• Viscometer to measure viscosity for reservoir fluids.
• Anton Paar Stabinger viscometer/densiometer to measure viscosity and density of fluids.
• Automatic high sensitivity wide range cryoscopy to measure crude oil molecular weight.
• Rocker & high pressure cylinders to prepare and validate live fluids.
EORI Lab – Partial List
Targeted Work

• Evaluation of CO2 foam stability
• Completion of ASP studies
• Use of gels to improve reservoir conformance
• Evaluation of spontaneous imbibition
• Study of wettability change during flooding operations
• Wettability modification for near wellbore treatments
• Evaluation of miscible gas EOR
• Development of EOR methods for low permeability reservoirs
Reservoir Simulation

The reservoir simulation team develops dynamic models to evaluate reservoirs.

EORI and the University of Wyoming has access to cutting edge computer modeling hardware and software.

EORI provides technical support to small Wyoming operators who may not have access to these tools.
Economic Evaluations

EORI provides technical support for screening evaluations and feasibility studies. The initial evaluation is usually completed at no cost to operators and investors.

EORI also provides access to detailed economic evaluation tools (the CO2 economic evaluation model).
Since 1986 CO₂ EOR has produced an incremental 95.8 million barrels of oil in Wyoming; 208 million barrels in the Rockies system.
Shute Creek Gas Processing Plant

Description: World’s Largest Carbon Capture Facility, Shute Creek Gas Plant, Southeast Wyoming.
Date: Present

CO2 Supply in Wyoming

- CO$_2$ Supply in the Rockies could increase by as much as 1 Bcfpd over next 5-10 years.
- The Madison Formation in the LaBarge Platform contains 100 TCF of CO2 reserves.
- Existing plants at Shute Creek and Lost Cabin can produce up to 390 MMcfd of CO2.
- Additional CO2 production will be developed from gas production, ex-situ coal treatment, and in situ coal gasification.
New Technologies
Underground Coal Gasification

Description: Underground Coal Gasification Near Hanna, WY
Date: 2012

Courtesy of: Midwest Energy News
Market Drivers – Target Growth

Total, Primary, Waterflood, Main Pay and ROZ CO₂ Performance
(the Concept of "Brownfield" Quaternary Oil)

Annualized Oil Production in bopd

Year

0 10 20 30 40 50 60 70 80 90 100

0 10,000 20,000 30,000 40,000 50,000 60,000 70,000 80,000

TOTAL OIL - bopd
Proj Primary-bopd
Proj Waterflood-bopd
Main Pay EOR Baseline
Quat 2.0 Oil - bopd

Primary
Production Peak

Secondary
Production Peak

Tertiary CO₂ Production Peak

Quaternary CO₂ ROZ Production Peak

Primary
Cum = 125 mm bbls

Secondary
Cum = 325 mm bbls

Tertiary
Cum = 200 mm bbls

Projected
Quaternary
Cum = 200 mm bbls
Energy Innovation Center

- Laboratories for study of multiphase flow, petrophysics, improved oil recovery, enhanced oil recovery, characterization of reservoir matrix and fluids, and coal processing.
- 3D Audio/Visual Lab.
- Advanced software for reservoir modeling.
- State-of-the-art meeting rooms.
Gifts to EORI

• EORI has enjoyed increased gift giving during the past 18 months.
• Thank you to those who have contributed.
• Uses for gifts
  – Intern program
  – Excellence program
• Contact EORI Outreach Staff if you are interested in participating.
Energy Innovation Center
Questions?

David Mohrbacher
jmohrbac@uwyo.edu
307 766 2739