EORI
Wyoming Joint Producers Meeting

CO$_2$ in Wyoming

The Beaver Creek Madison CO$_2$ Project

June 26, 2007
Overview

• Geographic Setting
• Geologic and Reservoir setting
• History of the field & evaluation
• Phased Evaluation Methodology
• Project Status
CO$_2$ Floods in Wyoming

- Devon
  - Beaver Creek Field

- Anadarko
  - Patrick Draw Monel Unit
  - Salt Creek Field

- Merit Energy Wertz/Lost Soldier
Beaver Creek Madison Structure

Approximate Oil - Water Contact

**Reservoir Characteristics**
- Porosity = 10%
- Permeability = 9 md
- Reservoir Temp = 234°F
- BHPi = 5301 psia
-GORi = 288 scf/bbl
- Bubble Pt. = 673 psia
- Swi = 10%
- Oil Gravity = 39.5° API

**Geologic Characteristics**
- Limestone/Dolomite Matrix
- Approx. Prod. Area = 974 Acres
- Approx. Oil Column Height = 820’
- Avg. Net Pay Thickness = 212’
- Avg. Depth to Madison Top = 11,100’

**Type Log**
Madison Log Section
(GR/ Bulk Density)

- BCU #127 Well
- Top @ 11224’ MD
- Bottom @ 11723’ MD
Beaver Creek Madison Structure Viewed From the South
## Background & Evaluation History

### Beaver Creek Madison Field

- Madison reservoir discovered January 1954
- Waterflood initiated in 1959 with peripheral flood
- Water injection expanded to pattern flood through 1964 -
- Reservoir developed with 36 completions
- Currently have 21 active wells including 12 producers and 9 injectors
- Current Production of 300 bopd, 29,000 bwpd & 13,000 bwipd
- CO$_2$ flood potential originally identified in Amoco’s 1987 CO$_2$ Feasibility Study
  - Determined marginally economic in 1987 (low oil price)
  - Identified need to review fracture intensity
  - Obtain measured rel/perm and rock data
- Devon revived the project idea in January 2005
Beaver Creek Madison Production History

Early waterflood

Main Block (Target)

OOIP = 109 MMbo
Cum Oil = 42.5 MMbo (39% OOIP)
Rem = 2.6 MMbo
Evaluation Methodology

Three Phase Evaluation Process

Phase 1 - Initial scoping and feasibility review
Phase 2 - Data acquisition & detailed sector modeling
Phase 3 - Final full field 3D modeling and flood design
Phased Evaluation

Phase 1 - Initial scoping and feasibility review

• Gathering & Evaluation of Existing Data
• Review Against Screening Criteria
• Analytical Simulation
• Preliminary economic evaluation
Phase 2 - Data acquisition & detailed sector modeling

- Build production and well history database
- Reservoir engineering analysis
- Secure special core and PVT data
- Build 3D compositional model
  - Mechanistic numerical simulation (fine scale)
  - Sector Forecast
Phase 3 - Final full field modeling and flood design

- Full field 3D compositional model
  - History matching
  - Identified where remaining oil exists
  - Forecast
    - Base (as is) forecast
    - 4 Development pattern options
  - Sensitivity analyses
    - WAG cycles
    - Surface facilities limitations

- Final Economic analysis
Phase 3 - Full Field Compositional 3D Model
Phase 3 - Forecast

Flood Design Options

Plan 1: Peripheral CO$_2$-WAG
Plan 2: Pattern CO$_2$-WAG
Plan 3: Combined Plan 1 & Plan 2
Plan 4: Peripheral-Gravity drainage
Plan 1 – Peripheral CO2-WAG

2008 Status

14 Injectors:
- 8 WAG injectors
- 6 CO2 injectors

17 Producers

12 Shut-in or producing from other formation or TA

Detail:
- 3 well conversion (prod->Inj):
  - 44, 146, 143
- 8 old producers:
  - 11, 38, 41, 46, 68, 147, 66, 81
- 2 shut-in:
  - 14, 96
- 6 old injectors:
  - 40, 17, 30, 32, 45, 139
- 7 new producers:
  - D, E, F, G, H, I, J, L
- 4 new injectors:
  - A, B, C, K
- 1 Injector reactivation:
  - 31
- 1 Producer reactivation:
  - 77

Low confidence inside this area
Plan 2 - Pattern CO2-WAG

2008 Status

18 Injectors:
All WAG injectors

14 Producers

Detail:
2 well conversion (prod->Inj):
   44, 146,
9 old producers:
   11, 38, 41, 46, 68, 147, 66, 81, 143
8 old injectors:
   40, 17, 30, 32, 45, 139, 14, 96
4 new producers:
   L, D, E, J
8 new injectors:
   A, B, K, H, F, G, I, C
1 Producer reactivation:
   77
Results - Summary

Plan 1

Plan 2

Plan 3

Plan 4

Oil rate (stb/d)

Work Requirements

• Convert 3 wells from producer to injector
• Rework or recomplete 15 wells
• Drill 8 new producers & 4 new injectors
• Construct Production & Injection Facilities
• Install New Flowlines for Producers & Injectors
• Build CO2 Supply Pipeline
Beaver Creek Madison CO$_2$ Flood

Where Are We Today?

- Drilling program initiated
- Rework/recompletion program under way
- CO$_2$ gas contract in place
- CO$_2$ pipeline construction to begin September
- Distribution and flow lines ordered
- Compressor & Dehydrator ordered
- Facilities construction to begin this week

July 2008 project start
Modeling Risk Reduction

Phase-I Analytical
Phase-II Numerical (Sector Model)
Phase-III Numerical (Full Field)