Wyoming EORI
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The Beaver Creek Madison
CO2 Project - Spring 2008
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Beaver Creek Madison CO₂ Flood Project

Overview

Geographic Setting
Geologic and Reservoir setting
Field History
Final Project Design
Project Construction
CO₂ Floods in Wyoming

- Devon Beaver Creek Field
- Anadarko Salt Creek Field
- Anadarko Patrick Draw Monel Unit
- Merit Energy Wertz/Lost Soldier
Beaver Creek Madison Structure

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

Active Oil Producer
Active Water Injector
Beaver Creek Madison Structure Viewed From the South
Madison Log Section
(GR/Buld Density)

BCU #127 Well
Top @ 11224’ MD
Bottom @ 11723’ MD
Background & Evaluation History

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
CO₂ flood potential originally identified in Amoco’s 1987 CO₂ Feasibility Study
- Determined marginally economic in 1987 (low oil price)
- Identified additional data needs to mitigate risk
Devon revived the project idea in January 2005
Beaver Creek Madison Production History

- Main Block (Target)
  - OOIP = 109 MMbo
  - Cum Oil = 42.5 MMbo (39% OOIP)
  - Rem = 2.6 MMbo

Early waterflood
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 3D Compositional Model
Phase 3 - Modeling 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

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
Plan 2 - Pattern CO2-WAG

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

Well status:
- Black = active
- Red = Inactive
- Blue = injector

Remaining oil in place (rb/acre)
Flood Preparation Work Requirements

• Convert 2 wells from producer to injector
• Rework or recomplete 9 producers & 7 injectors
• Drill 7 new producers & 5 new injectors
• Construct Production & Injection Facilities
• Install New Flowlines for Producers & Injectors
• Build CO2 Supply Pipeline
Beaver Creek Madison CO\textsubscript{2} Flood

Where Are We At Today?

Construction & Wellwork Initiation

Infrastructure Work Under Way
  - May 2007 Drilling Program Initiated
  - July 2007 Flowline Construction
  - February 2008 Facilities Construction underway

Progress to Date

Drilling program
  - 7 Wells D&C, 3 Drilled, 2 WO Rig
Rework/recompletion 95% complete
CO\textsubscript{2} gas contract in place
CO\textsubscript{2} pipeline construction
  - 100 % Completed
  - 75% hydro-tested
Distribution and flow lines installation complete
Compressors & Dehydrator Fabricated and Ready for Delivery
Process Vessels Set - Piping in Progress

July 2008 Project Startup
Drilling Operations In Progress
State of the Art Rig Controls
Driller’s View
Automated Pipe Racks
Flex Mud Lines to Accommodate “Walking” Rig
Mud Pit
CO₂ Delivery Line ROW Terrain

CO2 Line coming off Beaver Rim

8 inch CO2 Line
Recycle Compressor Fabrication
Intermediate Pressure Compressor Skid
Madison Well #66 Production Line- 1st ditch dug

Kevin Watson (L) and Bill Skelton (R)
Carbon Steel Production Line Pipe
High Volume Gas Gathering Lines

6” Sweet Gas Line From Riverton Dome

10” Low Pressure Line: Beaver Creek Sweet
Injection Header Building Construction
Oil Tanks / Compressor Foundations / Cooler Foundations
Thank You.