Development and Performance Update of the Cambrian Reservoir in Bairoil

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The 4th Annual Wyoming CO₂ Conference
June 29th and 30th, Casper, Wyoming
Agenda

- Field History
- Geologic Setting
- Field Operations Overview
- Production History
- Cambrian Reservoir Development
  - Geology
  - Cambrian Production Performance
  - Cambrian Downspacing Plan
  - Results to date
  - Future Plans
• Discovery
  • 1916 by Bair Oil Company
  • 269’ well in 1st Frontier Formation
  • Lost Soldier No. 1 IP = 200 bopd.
  • Earliest production from shallow horizons
    ➢ Frontier, Muddy, Lakota, Morrison and Sundance

• Development
  • 1930’s: Lost Soldier Tensleep discovered
    ➢ Well IP = at 2,435 bopd
  • 1936: Wertz Field discovered

• Unitization
  • Wertz: 1937
  • Lost Soldier 1962

• Secondary & Tertiary Floods
  • Waterfloods initiated in the mid/late 1970’s
  • CO₂ Floods initiated in the late 1980’s
1930 - Lost Soldier Tensleep Discovered

1947 - Lost Soldier Darwin-Madison Discovered

1948 - Lost Soldier Cambrian Discovered

1962 – Lost Soldier Field Unitized

1999 – Merit Energy Company Purchased Field

1980’s – CO2 Floods Initiated

1979 – Wertz Cambrian Discovered

1970’s – Water Floods Initiated

1948 – Wertz Darwin-Madison Discovered

1937 – Wertz Field Unitized

1937 – Wertz Tensleep Discovered

1970’s – Wertz Field Unitized

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- Field Discovery: 1916
- Field Size: 5 X 3 Miles
- Reservoir Depth: 4,500-7,500 ft
- Reservoir Thickness: +/- 1,000 ft
- Original Oil in Place: 660 MMBO
- Recovery to Date: 342 MMBO
**Location:**
- Great Divide Basin
- Northwestern edge of the Rawlins Uplift

**Structure:**
- Faulted anitclines
- Eight Producing Horizons (youngest to oldest)
  - Frontier
  - Muddy
  - Lakota
  - Sundance
  - Tensleep (CO$_2$)
  - Darwin (CO$_2$)
  - Madison (CO$_2$)
  - Flathead (CO$_2$)

**Fields:**
- Lost Soldier:
  - 250 wellbores
  - 440 mmbbl OOIP
- Wertz:
  - 164 wellbores
  - 220 mmbbl OOIP
- Lost Soldier and Wertz are both faulted anticlines.
- Located in Wyoming’s Great Divide Basin
Field Statistics

Oil Production: 5,850 BPD
Natural Gas Liquids (NGL): 1,250 BPD
Water Production: 210,000 BPD
Gas Recycle Vol: 155,000 MCFD

Diagram:
- Production Wells 235
- Wertz Gathering Sites
- Lost Soldier Gathering Sites
- Main Battery
- Oil Sales Line
- Water Injection Plant
- Injection Wells 179
- CO2 Recycle Plant
- NGL/Cond Sales

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Lost Soldier and Wertz CO2 Purchases

- Daily Purchases
- Cumulative Purchased

CO2 Daily Purchases MMCF/Day

Cumulative Purchases BCF

Jan-86 Jan-89 Jan-92 Jan-95 Jan-98 Jan-01 Jan-04 Jan-07
Cambrian Development and Performance
- Current Well Status:
  - 11 Injectors
  - 11 Producers

- No Set pattern development.

- Inability to increase injection with current wellbores.

- Injection - 11,000 BWPD  
  10,000 MCFPD

- Production - 1,050 BOPD  
  15,000 BWPD, 11,450 MCFPD
Critical Reservoir Properties for the three main producing formations:

<table>
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<tr>
<th>Field</th>
<th>Formation</th>
<th>Lithology</th>
<th>Average Depth</th>
<th>Formation Thickness</th>
<th>Average Porosity</th>
<th>Air Perm md</th>
<th>Current Spacing</th>
<th>Res Press psi</th>
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<td>31.0</td>
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<td>340</td>
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<tr>
<td>Wertz</td>
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<td>6,200</td>
<td>425</td>
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<td>20.0</td>
<td>10 - 20</td>
<td>3,500</td>
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<td>6,625</td>
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- Primary production was attributed to fluid expansion, water influx and gravity drainage
- All of the formations above are currently CO₂ flooded
Bairoil Floods — CO₂ Utility (Economic Basis)

**Cumulative CO₂ Utility**
- LSCA = 9.2 mcf/stb
- LSDM = 13.6 mcf/stb
- LSTP = 18.7 mcf/stb
- WZDM = 20.1 mcf/stb
- WZTP = 16.6 mcf/stb
Phase I
LSCA 10 – Convert to injection-Complete
LSTP 89 - Deepen well & convert to injection –Complete
LSCA 156- Deepen well & convert to injection

Phase II
LSCA 53 – Horizontal Sidetrack & convert to injection
LSCA 234 – New Horizontal Producer
LSCA 233H – New Vertical Producer

Phase III
LSCA 120 – Convert to producer
LSCA 108 – Horizontal Sidetrack Injector
LSCA 235 – New Horizontal Producer
Thank You