Presentation Outline

• General Field Info and History

• Brief CO₂ Project Evaluation

• Performance & Reservoir Management
Basin Outline and Field Location

Wind River Basin

Beaver Creek area
Madison Reservoir Characteristics

**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’

**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
Stratigraphic Column and Typelog

Madison is subdivided into 4 zones, with the “D” zone being the primary producing zone.
Beaver Creek Madison
Production History

First Production 1955
Peak Rate 8500 bopd
Waterflood initiated in 1962

OOIP = 109 MMbo
Cum Oil (prim + sec) = 42.5 MMbo
Remaining Reserves (WF) = 2.6 MMbo
CO₂ Project Evaluation

Initial Screening Phase I: 2005
- Analogs & Screening
- Basic Reservoir & Geology Study
- Risk & Economics

Testing & Sector Model Phase II: 2006
- Perform Testing (MMP, MCM, PVT, Core, etc.)
- Build Sector Model
- Update Risk & Economics

Full Field Model Phase III: 2007
- Full Field Simulation
- Develop Flood Strategy
- Finalize Economics (D&C, Facilities, CO₂ Purchase)

Execution Phase IV: 2007-2008
- Finalize Flood Strategy
- Contract CO₂ & Build Pipeline
- Drill & Complete
- Facilities & Recycle Plant
Execution Phase

- Build CO₂ supply pipeline
- Construct production & injection recycling facilities
- Drill 7 new producers & 5 new injectors
- Install new flowlines for producers & injectors
- Rework or recomplete 9 producers & 7 injectors
- Convert 2 wells from producer to injector
Madison CO$_2$ Flood
Original EOR Flood Strategy

Flood Strategy
Combo Peripheral + Gravity Stable
Best Modeled Recovery
Most Flexible Well Plan
Madison CO₂ Flood
Production Results

Initiated CO₂ Injection 7/3/08

Pre-Flood
300 Bopd
32,000 Bwpd

Current Avg Rate
4200 Bopd
30,000 Bwpd
Madison CO₂ Flood
Current Oil & Gas Rates by Well

Oil Rates (bopd)
Gas Rates (Mcfd)
Madison CO₂ Flood
Managing Reservoir Pressure

Maintain Reservoir Pressure
> 2600 psi MMP

Began WAG in 5 Down-dip Injectors

Current Reservoir Pressure >3000 psi

Choked Back / SI Interior Producers

Converted 2 Wells to Injection

Balance Injection with Production
Madison CO₂ Flood
Reservoir Management

Unexpected production response in the BCU #124

Re-evaluated Seismic & Geo-Model
Beaver Creek Seismic Coverage

3D survey outline

Seismic Line A

Riverton Dome

Beaver Creek

Riverton, Wyoming
Original 3D vs. Reprocessed 3D
Seismic Line A-A’

Fault was previously un-defined on seismic

Fault separates upper Madison block from lower Madison block.

Primary backthrust fault

Primary objective (Madison LS)
Well 124 responds to CO$_2$ injection well 139

BCU #139 injector

BCU #124 producer
The Madison CO₂ zone is in the lower SE plate at both wells BCU #139 injector and BCU #124 producer.
Madison Structure Map

Old Madison Structure Map

New Madison Structure Map
Madison CO$_2$ flood
Reservoir Management

- **Simulation Updates**
  - History match actual CO$_2$ flood performance

- **Optimize Flood Performance**
  - Improved rate and reserve forecasting
  - Optimize reservoir and operating pressures
  - Forecast Impact of Various Operating Scenarios
    (Well Placement, WAG Ratio, Slug Size, CO$_2$ Utilization, Conformance)
Reservoir Simulation Update
Actual vs. Modeled Oil Production

GROSS OIL PRODUCTION FORECAST

P50 Model
- Actual

10-12 MMBO Net Reserves Anticipated
Tertiary Recovery

Tertiary Oil Recovery vs HCPV CO2 Inj

Tertiary Oil (bbl)

1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0

0 5 10 15 20 25 30 35 40

HCPV CO2 Inj (%)
CO₂ Utilization

Cumulative CO₂ Purchase Utilization vs Time

Utilization Goal ≤ 10 Mcf/bbl
Continued Reservoir Monitoring
Thank You.