Successful Mature Field Re-Development at Mount Poso Oil Field, Kern County, California*

Marc Cooper¹, Eddie Behm², Michael Lebaron², and Katy Jensen-Doescher²

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¹California Resources Corporation, Los Angeles, CA (marc.cooper@crc.com)
²California Resources Corporation, Los Angeles, CA

Abstract

The Mount Poso Oil Field was discovered in 1926 and has produced over 300 mmbo from a three way closure against an east dipping normal fault situated along the eastern flank of the San Joaquin Valley in Kern County, California. The field was on decline in January, 2012, producing 800 bopd from 300 wells in the Miocene Pyramid Hills Formation. A combination of sixty new horizontal wells, a waterflood project, and re-development of the Oligocene Vedder Formation have since increased production to over 3,000 bopd. Production is expected to increase further with a full field expansion of the waterflood and continued re-development of the lower Vedder Formation. The Vedder Formation was under primary production from its discovery in 1926, then steam flooded from 1973-1998 with a focus on the Upper Vedder, and finally shut-in from 1998-2012. The shallower clay-rich Pyramid Hills Formation was largely bypassed until the mid-1980's, followed by workover appraisal, and then became the focus of development with vertical new drills in 1999 with the first laterals in 2005. From 2005-2012 the average well rates decreased from 4 to 2.5 bopd. In 2012 a successful horizontal well program built off the lessons learned from earlier development increasing production to 2,000 bopd by the end of the year with many 50-125 bopd IP wells. A successful Pyramid Hills waterflood was implemented by incorporating an updated geomodel, testing fluid compatibility with swelling clays, and utilizing the large inventory of existing wellbores to minimize costs. Reappraisal of the previously abandoned lower Vedder Formation since 2013 has led to thirteen new drill wells and five workovers with rates ranging from 10-280 bopd. Renewed focus and shallow reservoirs with attendant low costs have allowed multiple development techniques to be tested successfully in a short period of time at the Mount Poso Field, realizing significant production growth in a mature field.
Successful Mature Field Redevelopment at Mount Poso Oil Field, Kern County, California

Marc Cooper (Geologist) | Eddie Behm (Reservoir Engineer) | Michael Lebaron (Production Engineer) | Katy Jensen-Doescher (Petrophysicist)
Field discovered by Shell in 1926 | CRC (Oxy, 2014 spinoff) acquired in 2007

Formations: Pyramid Hill and Vedder | Depths: 1,300’-2,000’

Oil Gravity: 15-18° API | Current production: 3,000 bopd
Mount Poso 20 Year Production Profile

- **BOPD**
- **Well Count**

CRC (Oxy) Acquired 2007
7° WSW Regional Dip

Normal Faults along strike

Basement is granitic at ~3,000'

Main Area is 3-way fault closure w/ ~400ft throw vs ~100ft in other Areas

Only Upper Vedder pays outside Main Area

Main Area is operated 100% by CRC and currently has >90% of production rate

This presentation focuses on the Main Area of Mt Poso
## EAST SIDE SAN JOAQUIN VALLEY STRATIGRAPHIC COLUMN

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### Mount Poso Main Area
- **Current Development**
- **Waterflood**
- **Primary**
Mount Poso Upper & Lower Shoreface Depositional Environments - Security 2BH Pilot Hole Core Photos

Pyramid Hill (36% Porosity, 10-100md perm)

Vedder (36% Porosity, 0.5-5d perm)
Mt Poso North – South Cross Section - Stratigraphy
Mt Poso West – East Cross Section – Original Oil Zones

1926-1971: Vedder Formation Primary Production
1970-80’s: Upper Vedder Line Drive Steam Flood Incline to Peak
1982-1998: Vedder Steamflood Decline - Downdip Expansion & Deepening
1990’s: Pyramid Hill Waterflood and Fireflood Pilots

Secondary target pilots - Not main production driver

Downthrown Block - Wet

Upthrown Block - Trap

Steamed Out

Water
2005-2008: Pyramid Hill Lateral Drilling
Improvements on 2005-08 Pyramid Hill Lateral Campaign

- Focusing on Pyramid Hill B-Sand
- Developing highest producing leases, Central & South Units
- Drilling w/ aerated mud to solve lost circulation & sidetracks
2012 - Present (CRC): Pyramid Hill Waterflood

- Pyramid Hill Waterflood
- Water Transition
- PH_Tran_Zn
- L-4V_OWC
- PH_OWC_UVed_OWC
- Downthrown Block - Wet
- Upthrown Block - Trap
- Steamed Out

Diagram showing stratigraphic layers and wells in the Pyramid Hill area.
41 Pattern Development
- Mostly CTI/RTP, only 9 new drills
- Initiated 4Q12 w/ strong response within 6mo
- First 19 patterns responded
- Subsequent 22 patterns recently developed & filling up

Enhanced facilities allowed re-appraisal of Lower – 4th Vedder Formation Sands beginning in 2013
2013 – Present (CRC): Attic Oil Play in lower Vedder Sands
Mount Poso Main Area Production History (CRC)

- **Acquisition**
- **Pyramid Hill B-Sand Laterals**
- **Pyramid Hill Waterflood**
- **Vedder Attic Oil**

**BOPD**

- **Jan-08**
- **Jan-09**
- **Jan-10**
- **Jan-11**
- **Jan-12**
- **Jan-13**
- **Jan-14**
- **Jan-15**
CONCLUSIONS

• After over 80 years of production at Mount Poso, redevelopment increased production from 800bopd in 2012 to 3,000bopd in 2015

• Multiple opportunities successfully incorporated in redevelopment
  • Pyramid Hill B-Sand Laterals
  • Pyramid Hill Waterflood
  • Vedder Formation Attic Oil Play

• Shallow Reservoirs with low development cost benefitted rapid redevelopment strategy

• Multi-use wellbores (waterflood + attic oil targets) & facilities synergies allowed for multiple opportunities to be pursued simultaneously

• Thank you to our Mount Poso Team + CRC Leadership & for your interest
OUR VALUES

**CHARACTER**
Acting with integrity and honor, without exception

**RESPONSIBILITY**
Achieving California’s high standards for safety and environmental protection

**COMMITMENT**
Empowering workers and promoting communities where we live and work
THANK YOU

&

QUESTIONS?