Production Data Analysis of Multi-fractured Horizontal Wells in Shale Oil Reservoirs

Kory Kearns[1], Hamid Emami-Meybodi[1], Dennis Alexis[2]

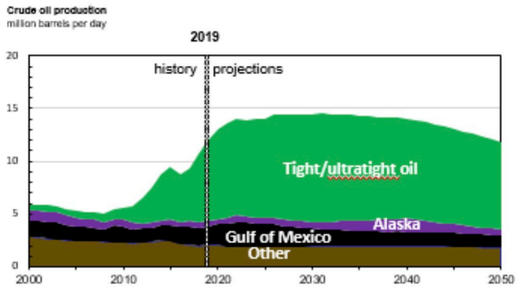
1: Penn State University, 2: Chevron

PennState College of Earth and Mineral Sciences

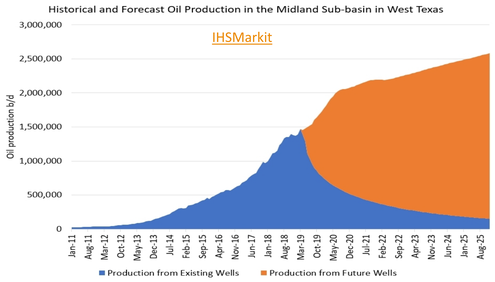
John and Willie Leone Family Department of Energy and Mineral Engineering

INTRODUCTION

❖Tight and ultratight reservoirs comprise >50% of current oil production in U.S.



❖Primary recovery from light/ultralight oil reservoirs is 2 -10% OOIP.



❖Oil prices are constantly cycling and changing

❖Petroleum Engineers analyze historic data to optimize production

❖This project's content involves a thorough analysis of three oil wells.

OBJECTIVE

❖ Analyze production data from three oil wells in a shale reservoir.

❖ Investigate the performance of fracking job.

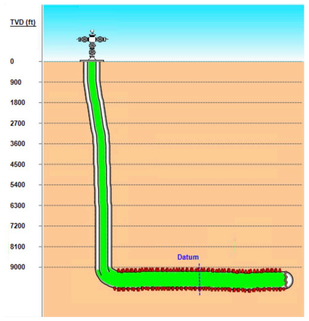
❖ Obtain hydraulic fracture properties, ultimate recovery, and original oil in place.

MATERIALS/METHODS

❖ Production Data
- ➢ Given production data for three unconventional oil wells
- ➢ PVT, relative permeability, deviation survey, production & surface pressure, and bottom hole pressure

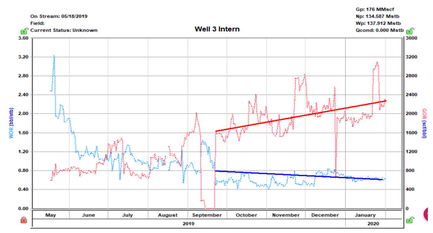
❖ IHS Harmony Enterprise
- ➢ GOR/WOR
- ➢ Typecurves
- ➢ Unconventional Reservoir Model
- ➢ Flowing Material Balance
- ➢ Numerical Model
- ➢ P90, P50, P10

Wellbore Schematic



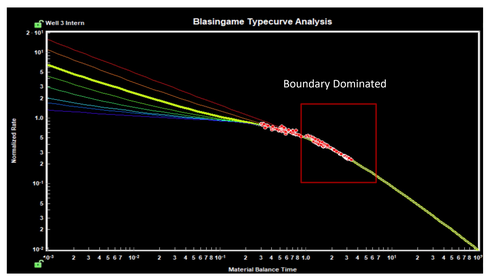
Reservoir Properties

p_i	4600.00	psi(a)
T_R	165.0	°F
h	300.0	ft
r_w	0.350	ft
ϕ_t	4.50	%
S_{gi}	0.00	%
S_{oi}	65.00	%
S_{wi}	35.00	%
c_{ri}	3.63e-06	1/psi
c_{ti}	1.35e-05	1/psi



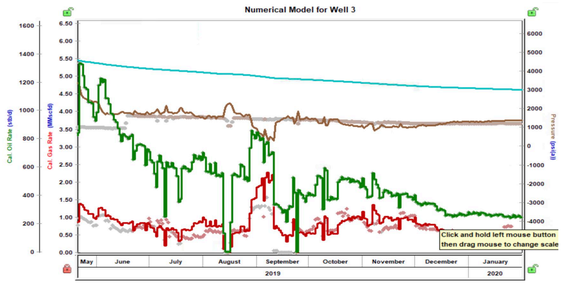
RESULTS

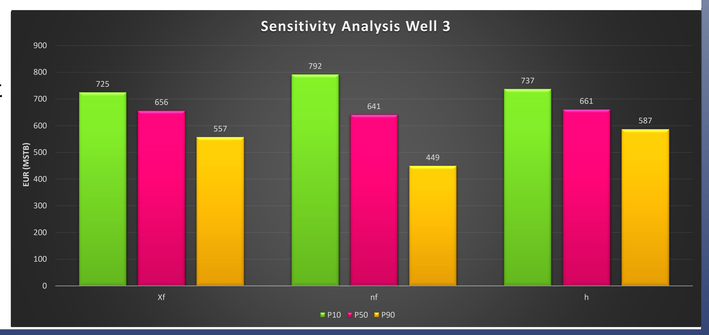
❖Typecurves
- ➢ Entered BDF
- ➢ OOIP: 2441.5 Mstb
- ➢ EUR: 488.3 Mstb



❖Sensitivity of Variables
- ➢ Monte Carlo Ran 300 times
- ➢ Fracture Half Length (Xf): 100-190ft
- ➢ EUR: 557-725 Mstb
- ➢ Number of Fractures (nf): 25-75
- ➢ Net Pay (h): 250-350ft

❖Numerical Modeling
- ➢ $k_{SRV} =$ $0.392\mu D$ and $k_m = 0.213\ \mu D$
- ➢ Xf = 145ft ; nf = 50ft ; h = 300ft
- ➢ Le = 7632ft





CONCLUSIONS

❖ Analyzed the performance of three unconventional oil wells using IHS Harmony.

❖ Software gives insights to how production is predicted to behave time(x) before the actual volumes are recovered.

❖ **Result** in insight of fracture properties which helps understanding of the fracture network and minimize environmental impact.

❖ **Results** also show that fracture half-length and number of fractures have greater impacts on the EUR of Wells 1-3 compared to the net pay.

❖ **Future Work** reconside data production with flowback.

REFERENCES

1. IHS Energy Enterprise, *Reference Materials*, http://www.ihsenergy.ca/support/documentation_ca/Harmony_Enterprise
2. IHS Markit, *The Learning Center by IHS Markit*, http://learning.ihsmarkit.com/learn/course/harmony-reservoir-unconventional
3. SPE, *Society of Petroleum Engineers*, http://www.spe.org/searchfilters

ACKNOWLEDGEMENTS

Chevron

PennState College of Earth and Mineral Sciences

IHS Markit