Review of Huff-n-Puff EOR in Unconventional Shale Reservoirs

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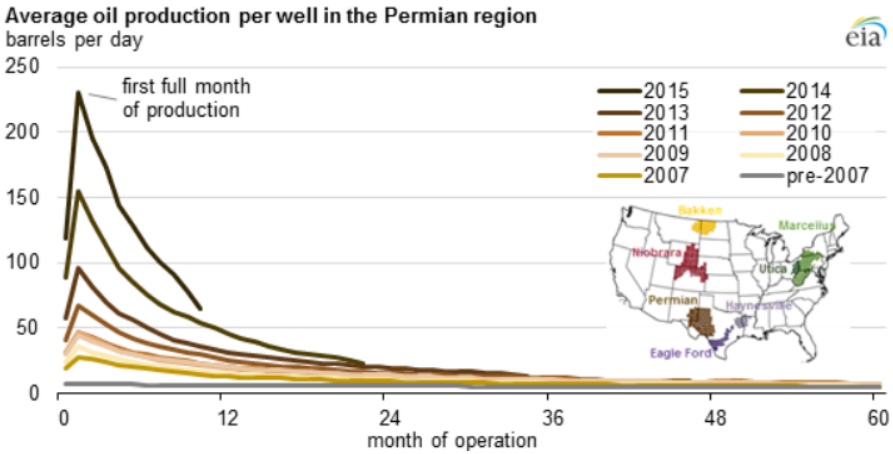
OGS EOR Workshop

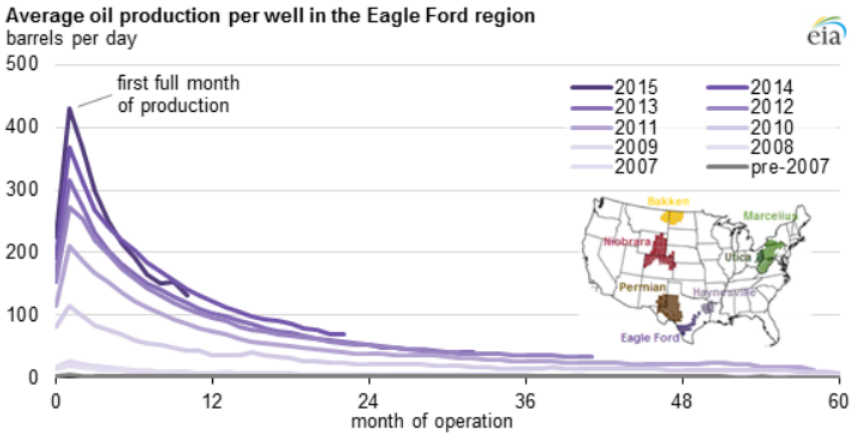
November 14th, 2019

Why EOR in Unconventional Shale Reservoirs ?

Permian

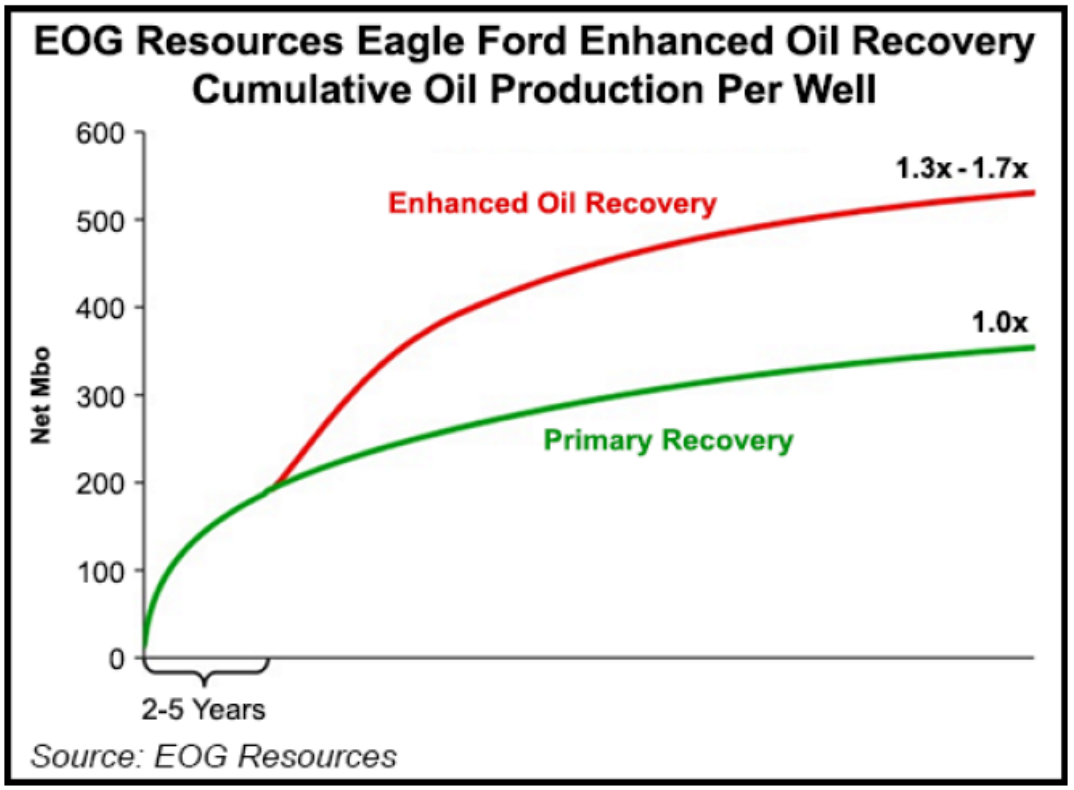


Eagle Ford



EIA (2016)

First Documented EOR Success in Shales

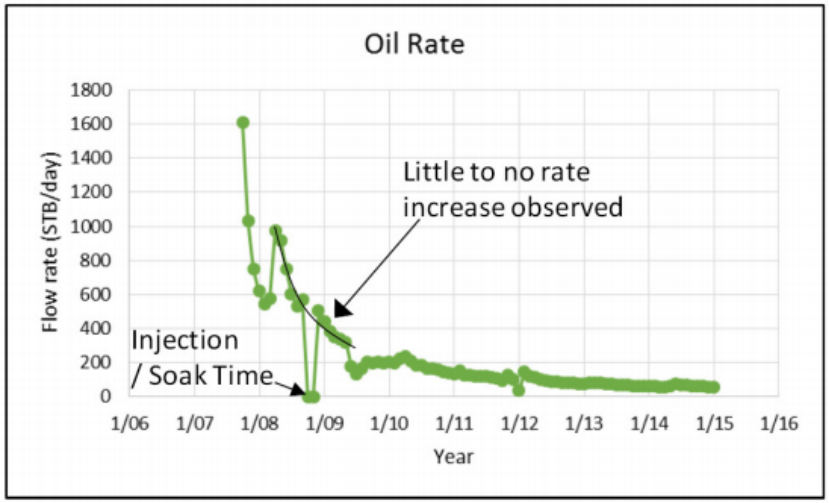


Thomas et al. (2016)

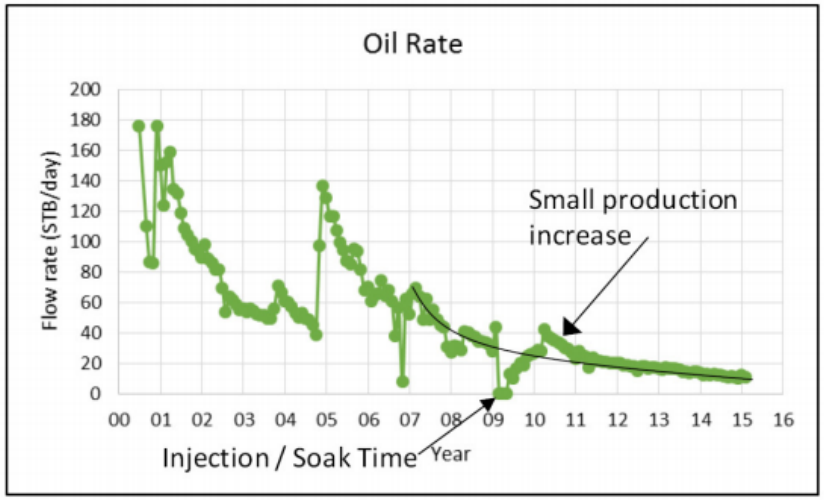
Early Attempts in the Bakken

CO2 Huff-n-Puff

Pilot 1



Pilot 2



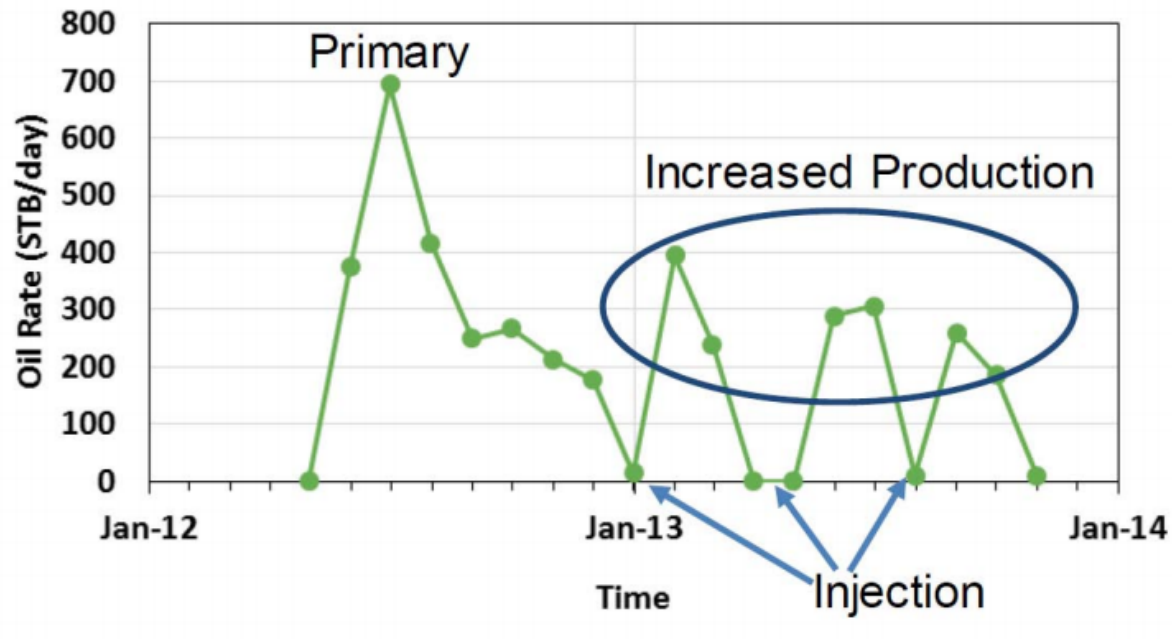
Hoffman and Evans (2016)

- Good injectivity
- Containment Issues

Huff-n-Puff in Eagle Ford

Produced gas Huff-n-Puff

Pilot 1 (1 Well in lease)

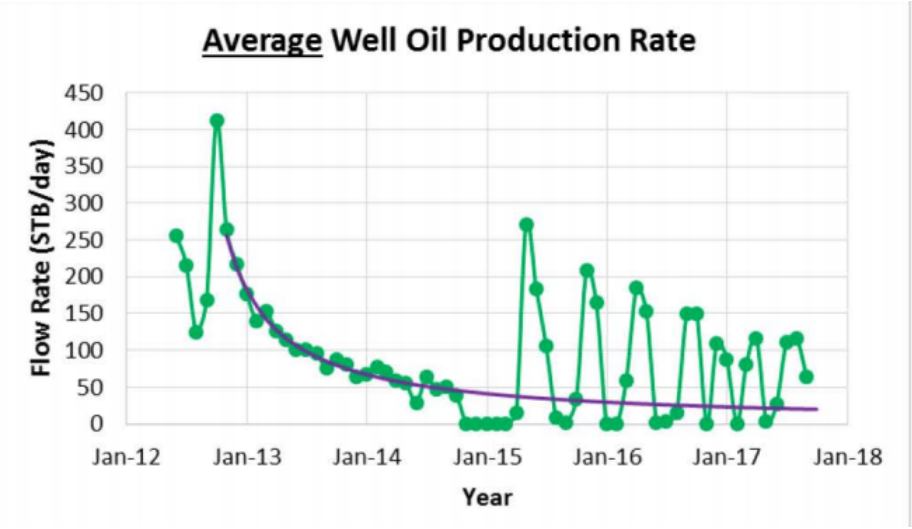


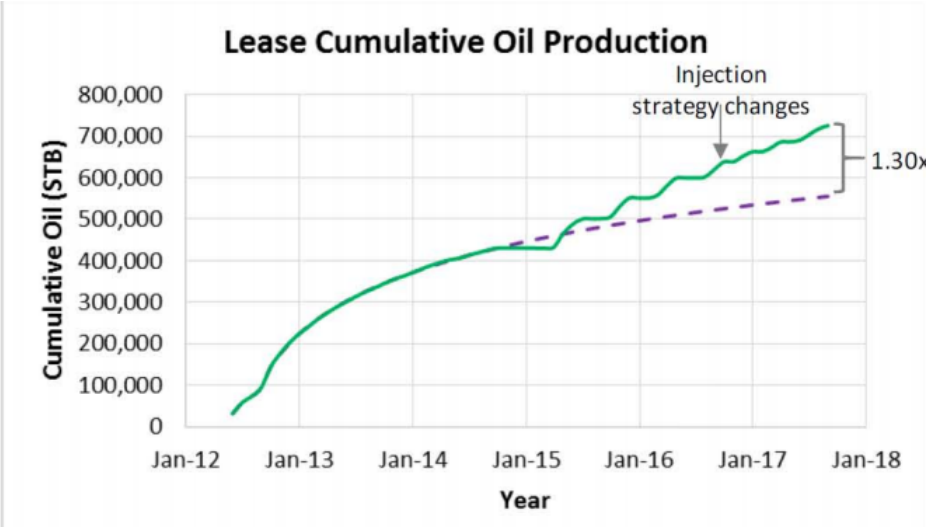
Hoffman (2018)

Huff-n-Puff in Eagle Ford

Produced gas Huff-n-Puff

Pilot 2 (4 Wells in lease)



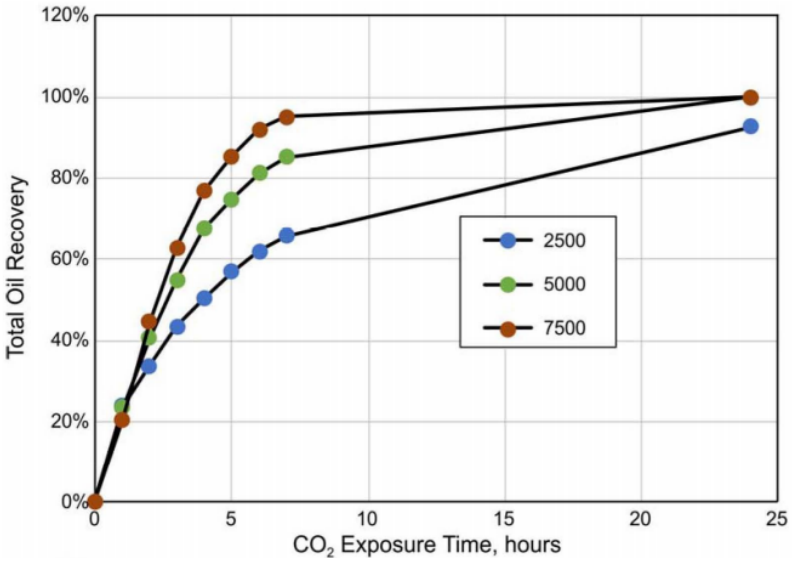


Hoffman (2018)

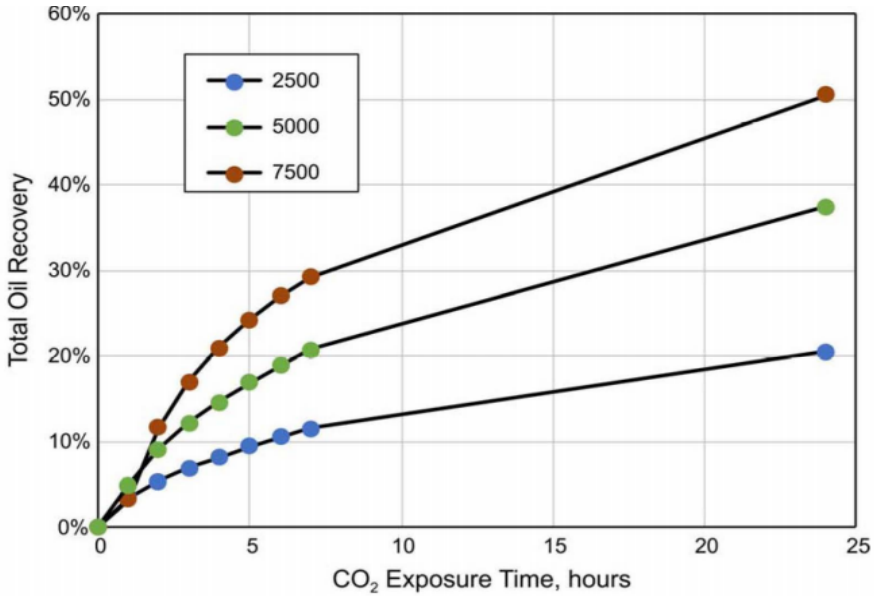
Laboratory Investigations

CO2 injection

Middle Bakken



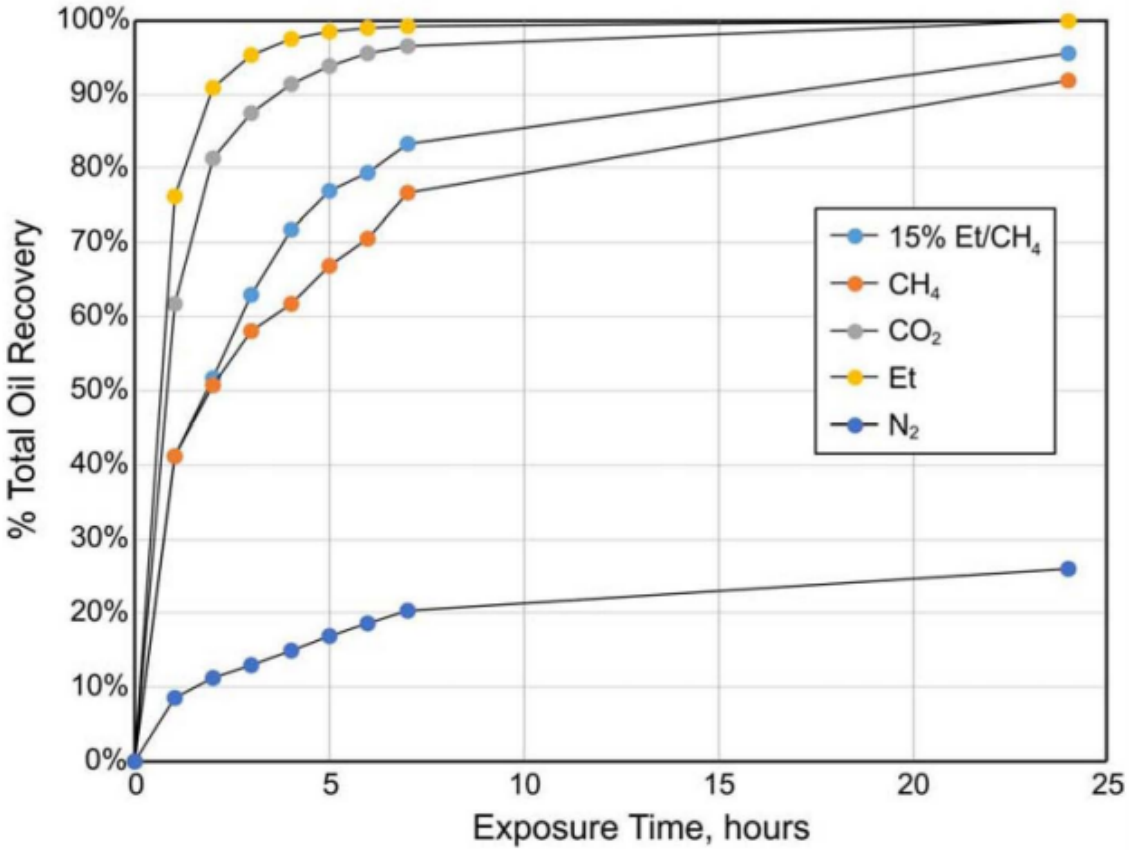
Lower Bakken



Hawthorne at al. (2017)

Laboratory Investigations

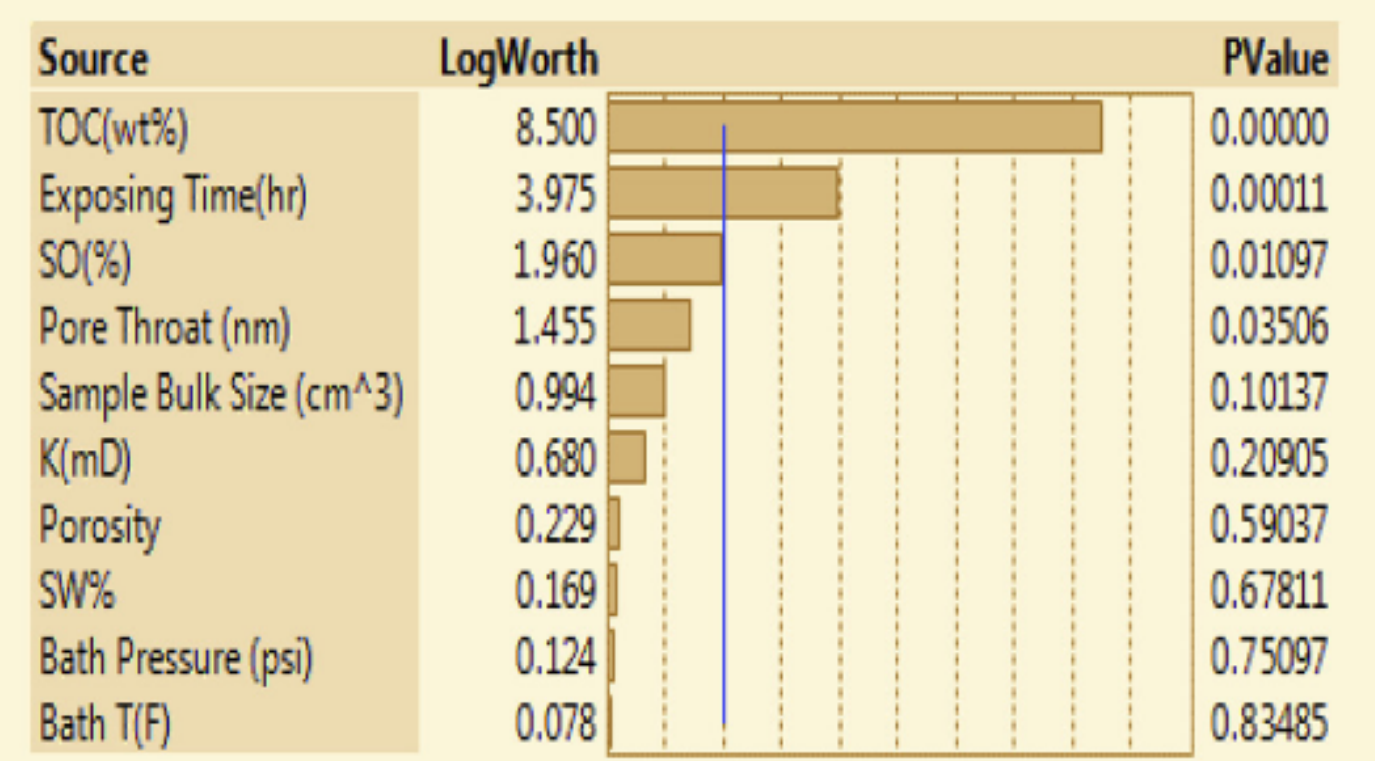
Middle Bakken



Hawthorne at al. (2017)

Laboratory Investigations

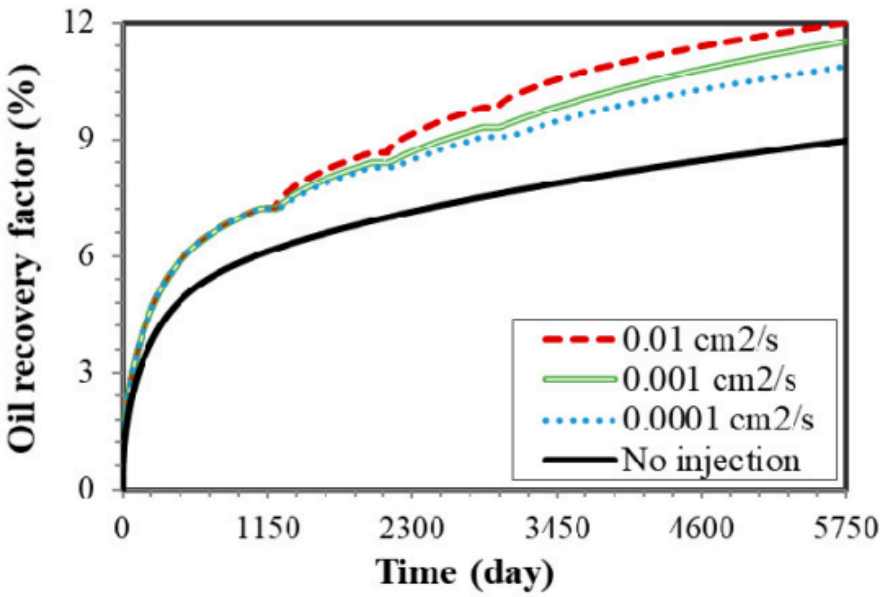
Bakken

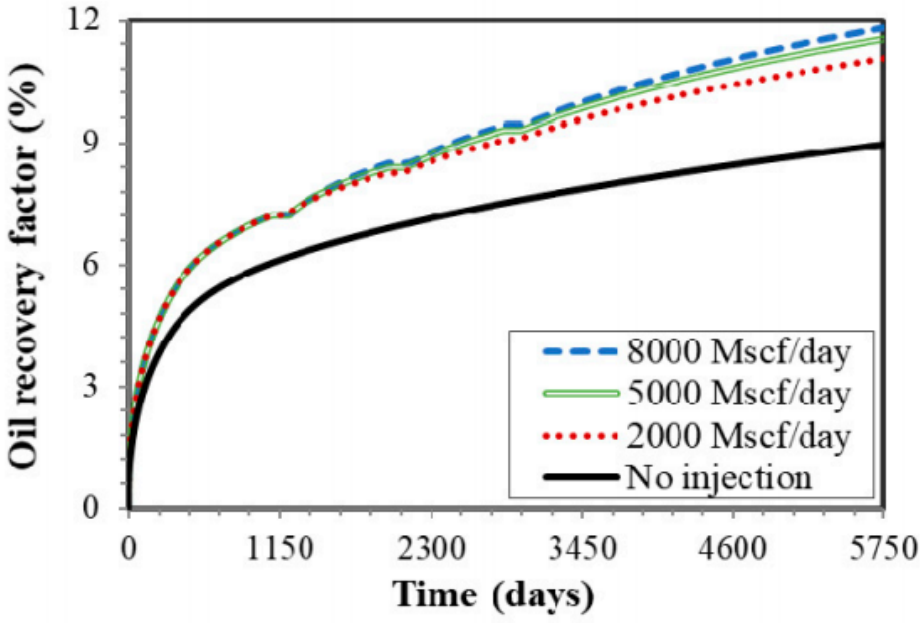


Source	LogWorth	PValue
TOC(wt%)	8.500	0.00000
Exposing Time(hr)	3.975	0.00011
SO(%)	1.960	0.01097
Pore Throat (nm)	1.455	0.03506
Sample Bulk Size (cm^3)	0.994	0.10137
K(mD)	0.680	0.20905
Porosity	0.229	0.59037
SW%	0.169	0.67811
Bath Pressure (psi)	0.124	0.75097
Bath T(F)	0.078	0.83485

Alfarge al. (2018)

Reservoir Simulation





Sheng et al. (2018)

Summary

Huff-n-Puff EOR success in shales depends on

- In situ fluid type
- Injection gas
- Injection pressure
- Injection and soaking time
- Reservoir quality
- Strategies to mitigate potential containment issues
- Initial completion strategy
- EOR implementation time