

Heavy Oil Recovery Research at the University of Alaska Fairbanks

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Senate Resources Committee

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TM

Outline

- Alaska's abundant heavy oil resources
- Why is heavy oil important?
- Why is it difficult to produce heavy oils?
- Other heavy oil recovery concerns
- Success of the Schrader Bluff pilot
- Targeting Ugnu – **P**olymer **A**lternating **S**olvent
- Acknowledgment



Alaska's abundant heavy oil resources

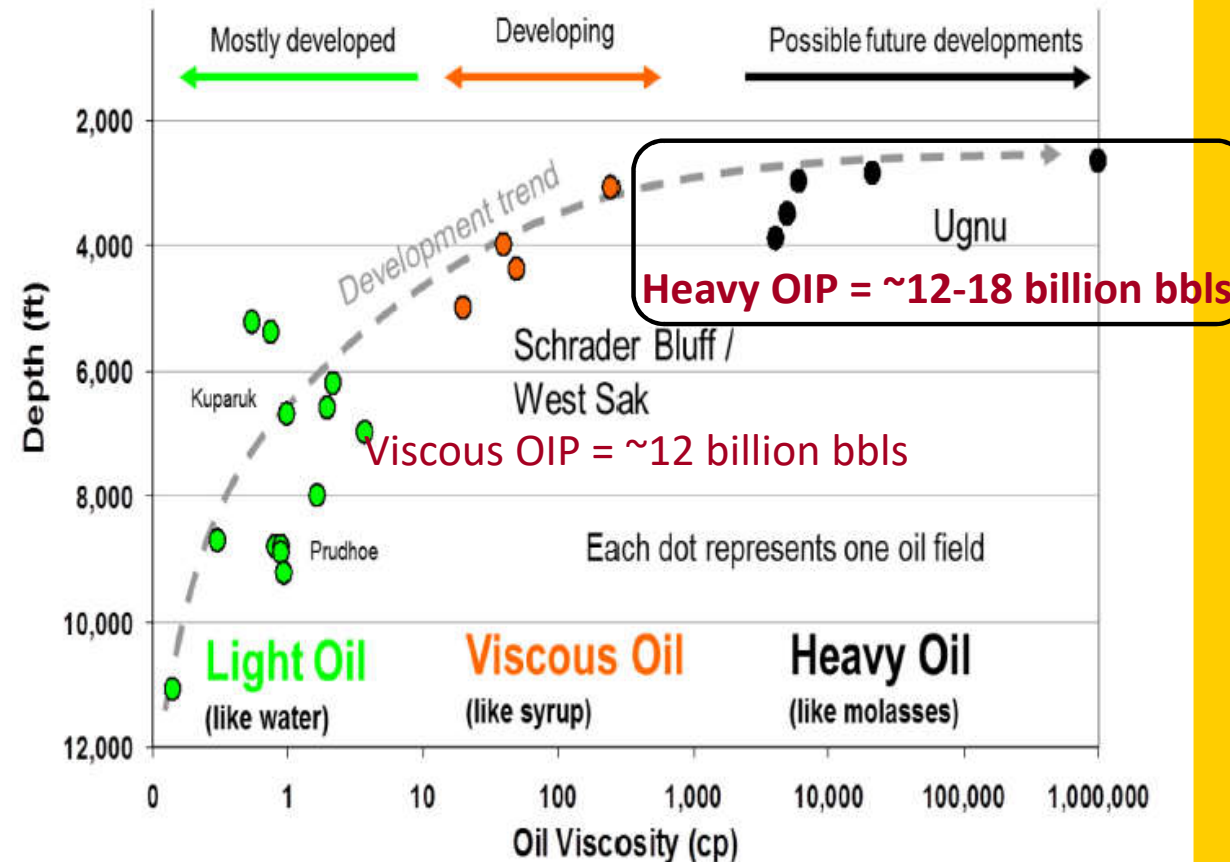
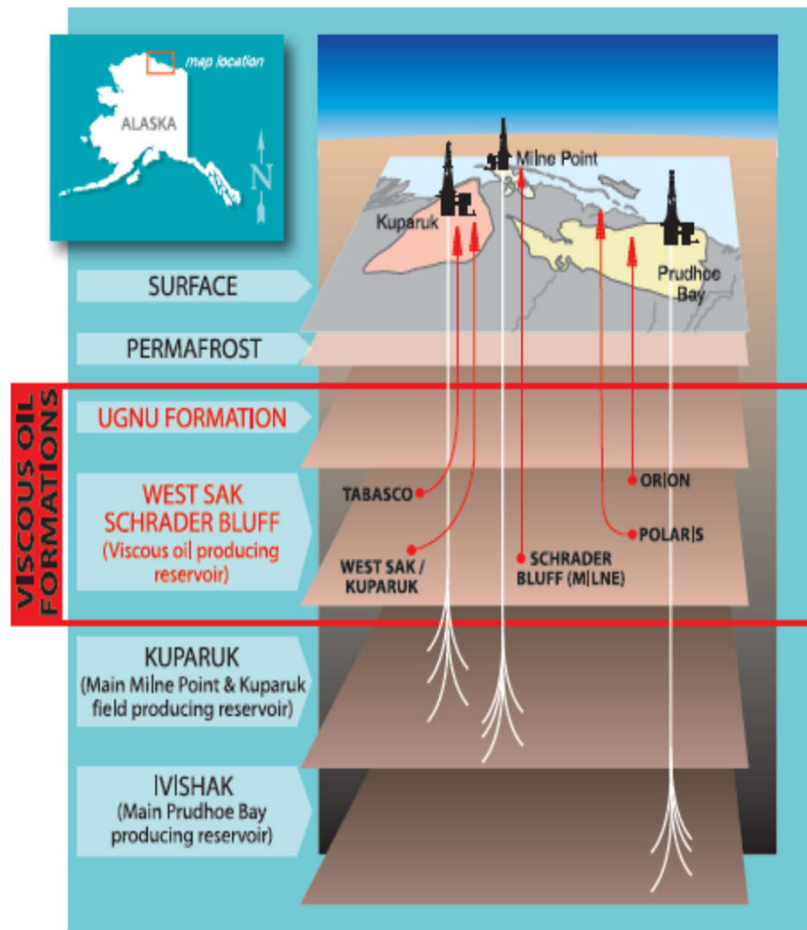


Figure sources: BPXA and Paskvan et. al. (2016)

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Why is heavy oil important?



- Strategic importance to the State of Alaska and the Nation
- Technology development “in Alaska for Alaska”
- **Resource too large to ignore, and within established and permitted infrastructure**
- Prudhoe Bay type diluent crude still available for heavy oil transport through TAPS. May be Willow in the future?

Figure source: Alyeska Pipeline Service Company



Why is it difficult to produce heavy oils?



Top: 2000+ cP Ugnu heavy oil

Bottom: 300+ cP Schrader Bluff
viscous oil

- Close proximity to the continuous permafrost
- Thermal methods inapplicable
- Low reservoir pressure
- Gas and/or water (1 cP) injection is inefficient due to viscosity

contrasts

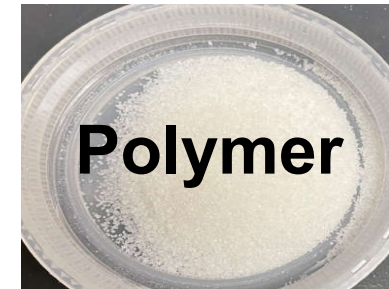


Sweep efficiency – a key factor

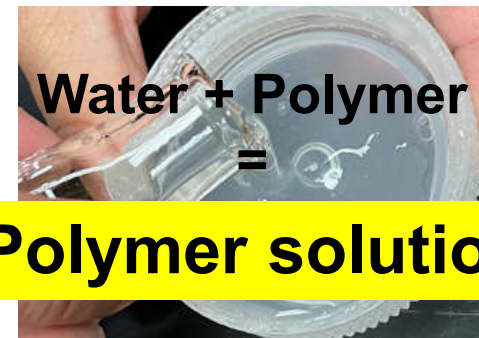
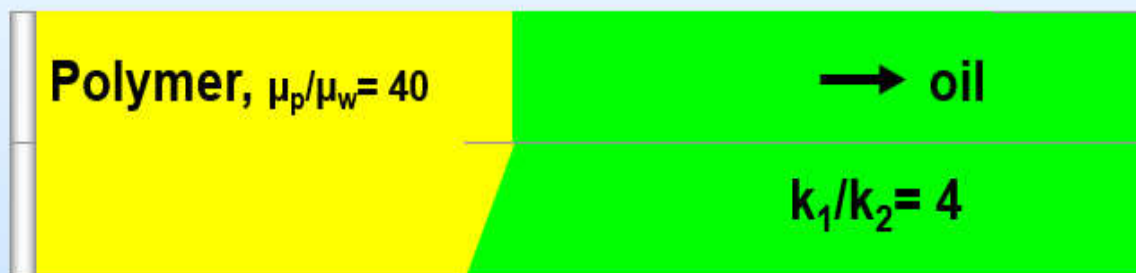
Water
flood:
 $M = 10$



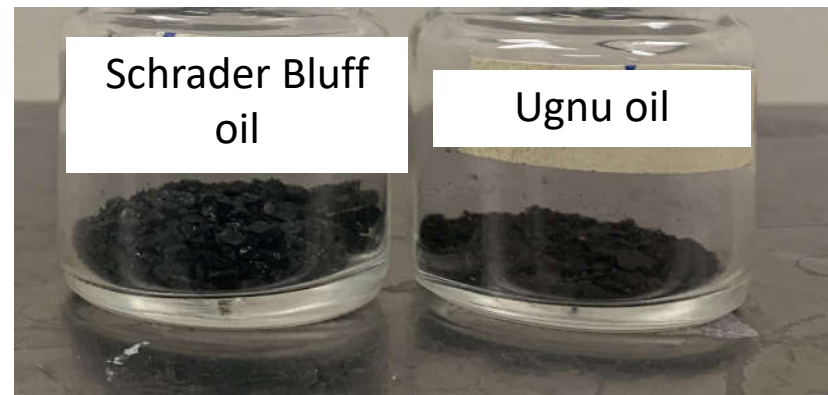
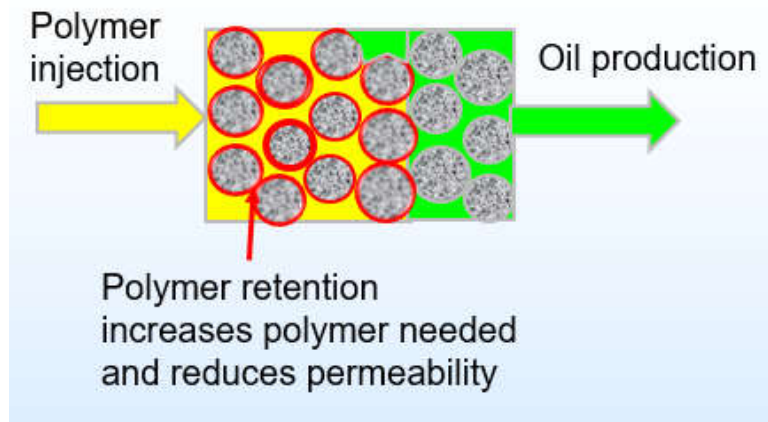
Polymer
flood:
 $M \sim 1$



Polymer
flood:
 $M \sim 0.25$



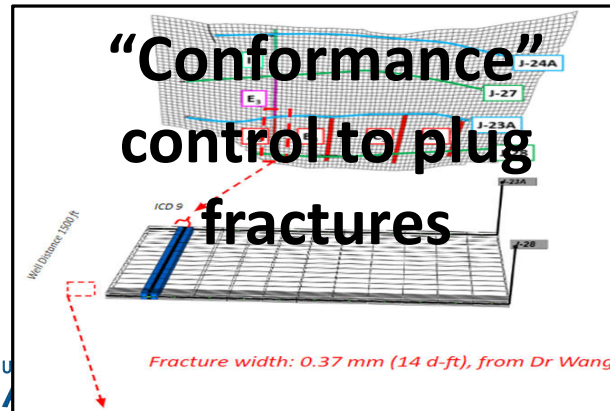
Other heavy oil recovery concerns



Deleterious components called "asphaltenes" may precipitate on contact with solvent



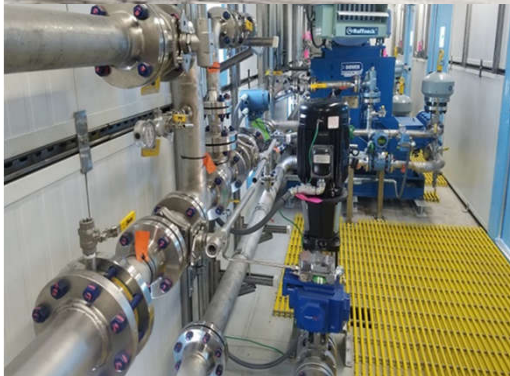
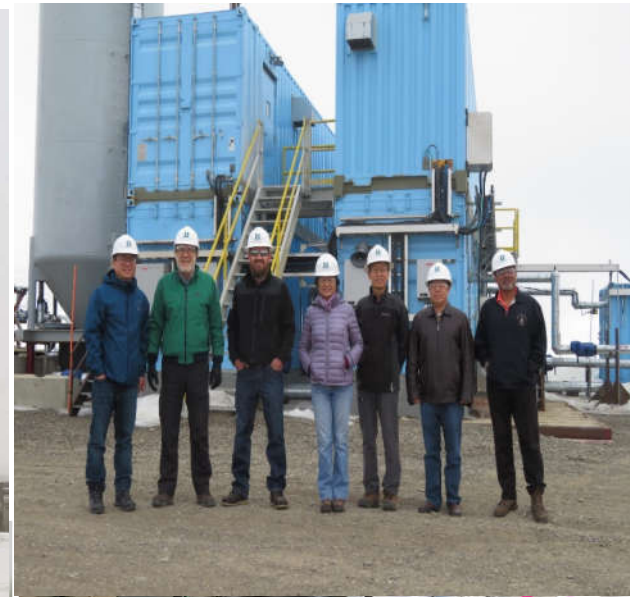
Heavy oil and water emulsions and fouling of heater tubes



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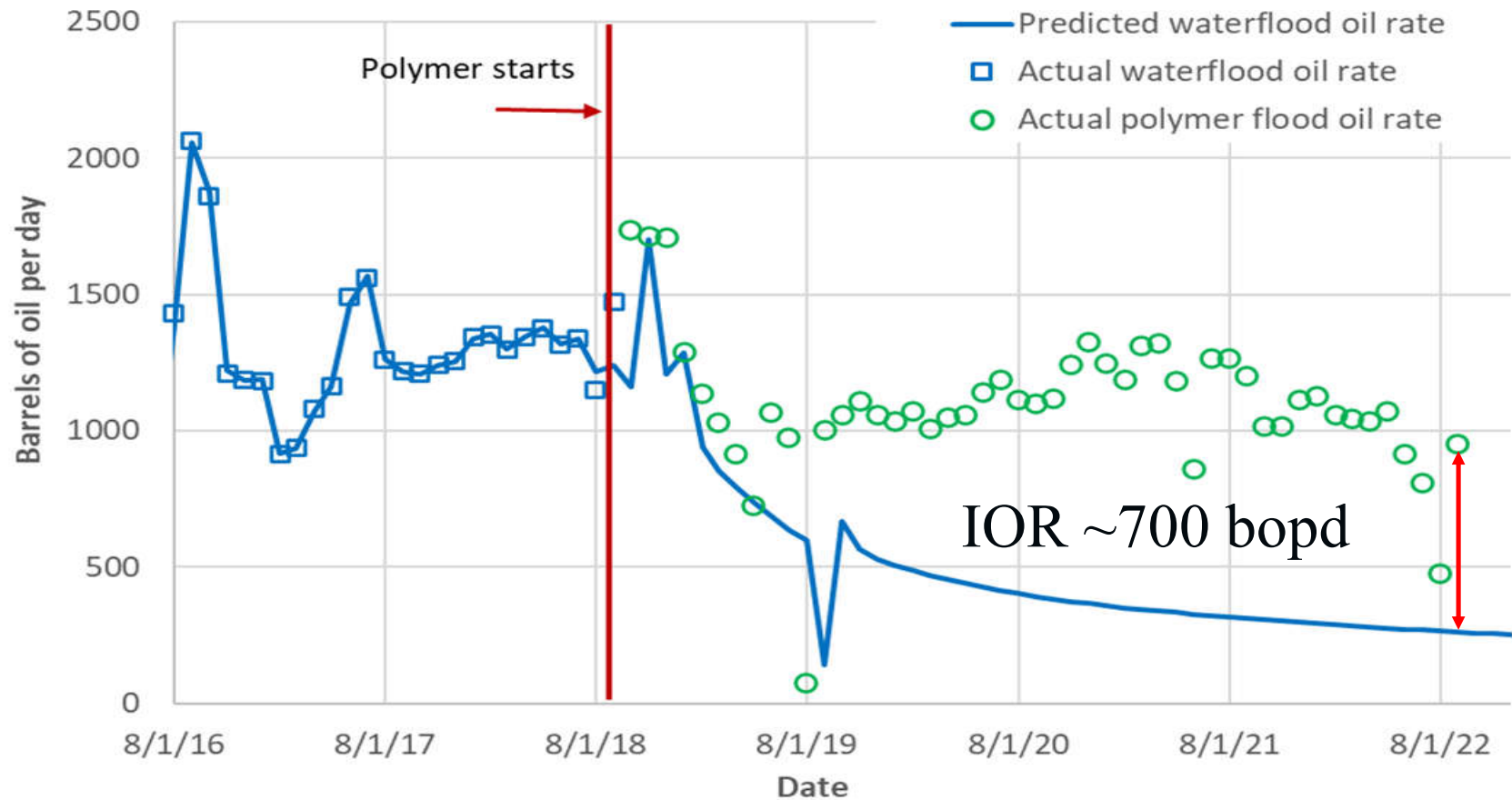


Success of the Schrader Bluff pilot



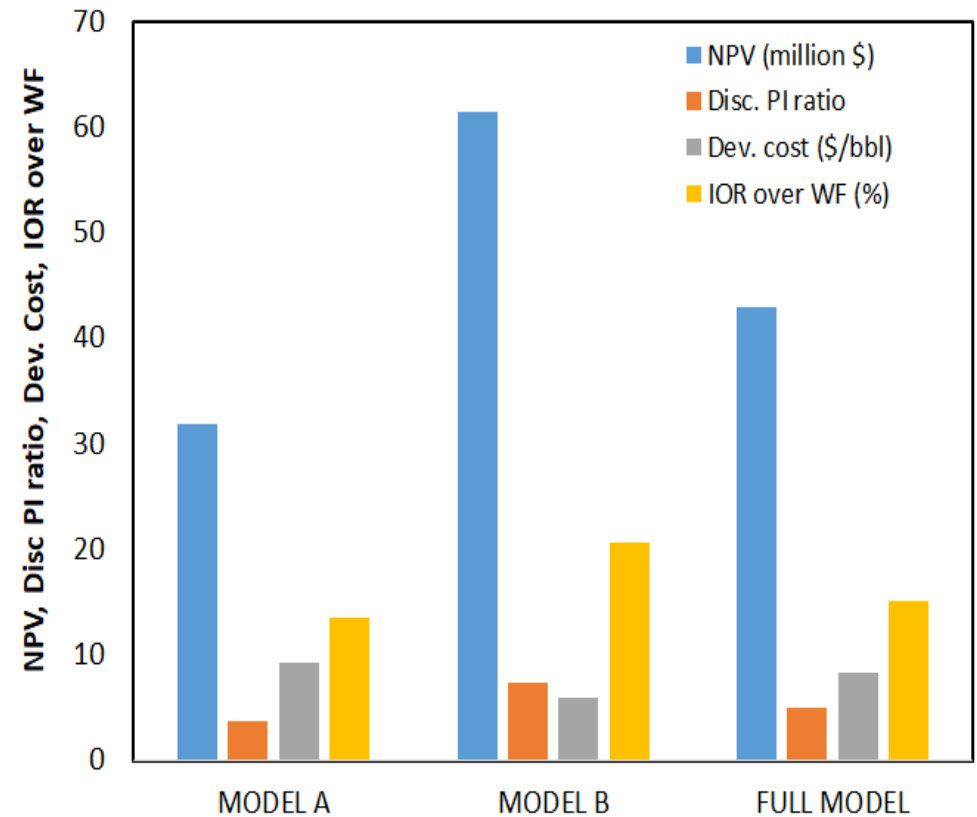
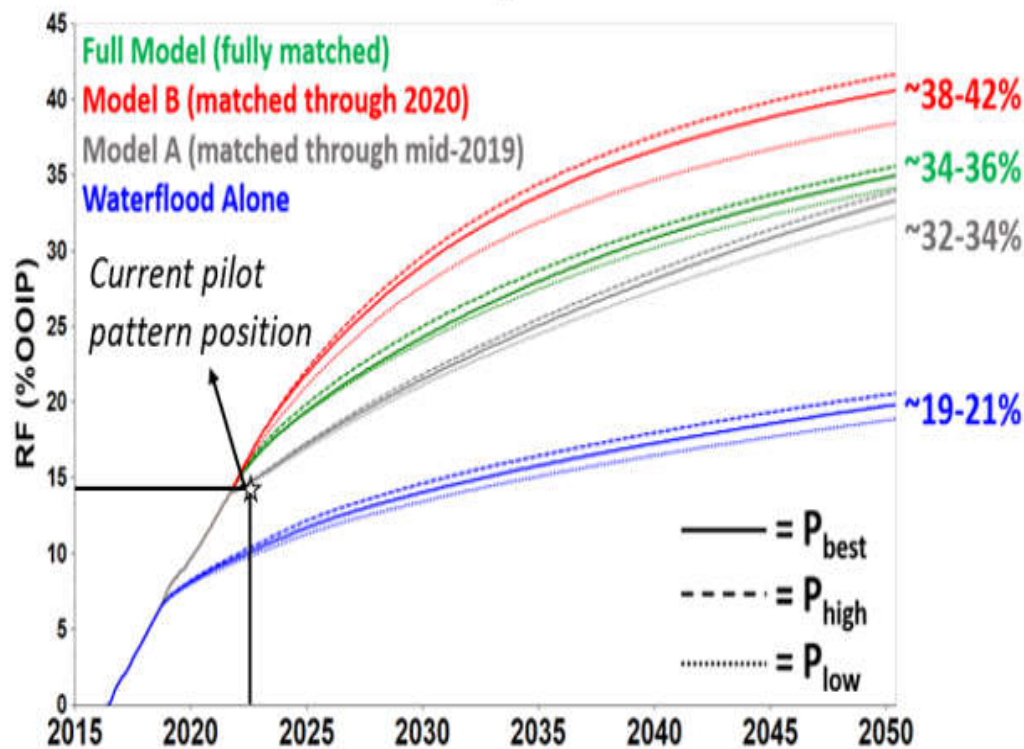
EOR benefit

Cum IOR = 832 mbbbl; Polymer utilization = 1.7 lb/bbl



Forecast and economic analysis

Oil Recovery Factor



Forecast figure modified from Keith (2022)

Workforce development

First place winner in the Western North America Region (April 2022) AND
Internationally (October 2022)



Targeting Ugnu – Polymer Alternating Solvent

Several orders of magnitude viscosity contrast
and injectivity constraints!

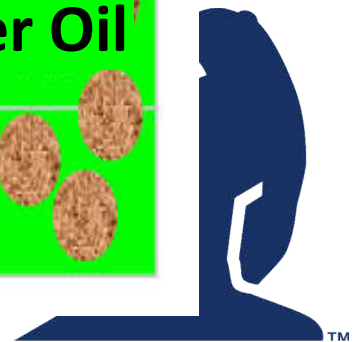
→
Polymer
flood?

2,000+ upto a million cP Ugnu Oil

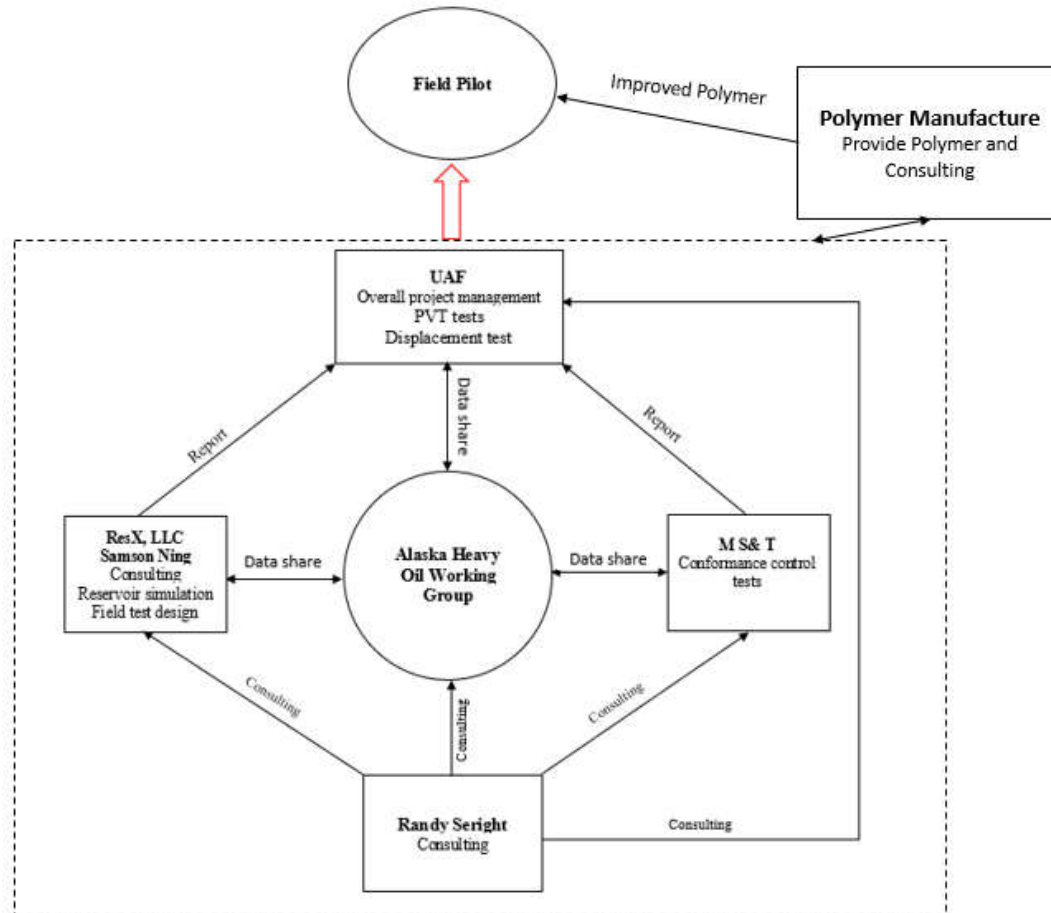
Polymer
flood

30-40 cP Polymer
CAN sweep

→ 300 cP Schrader Oil



Project management



UAF personnel

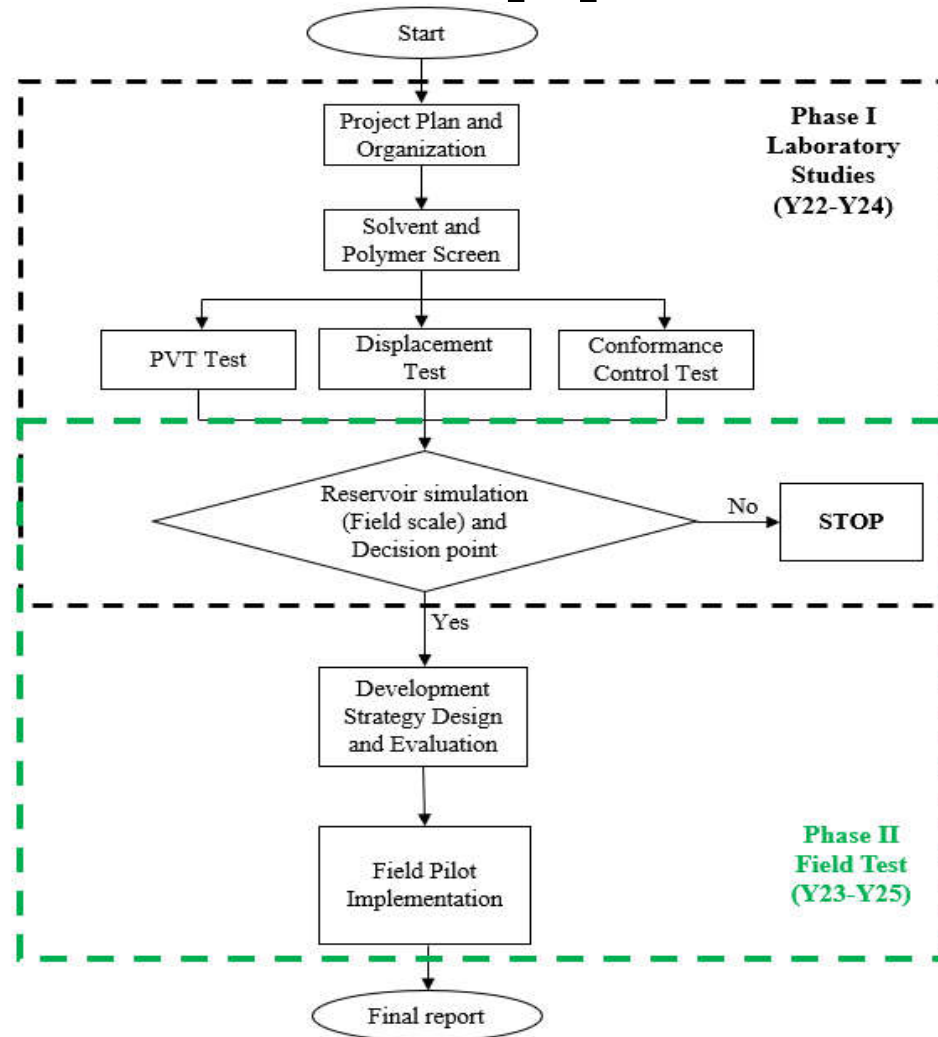
Yin Zhang, PI
Brent Sheets, Co-PI and Coordinator
Abhijit Dandekar, Co-PI
One lab researcher at PhD level
Two PhD students

Commitment from industry

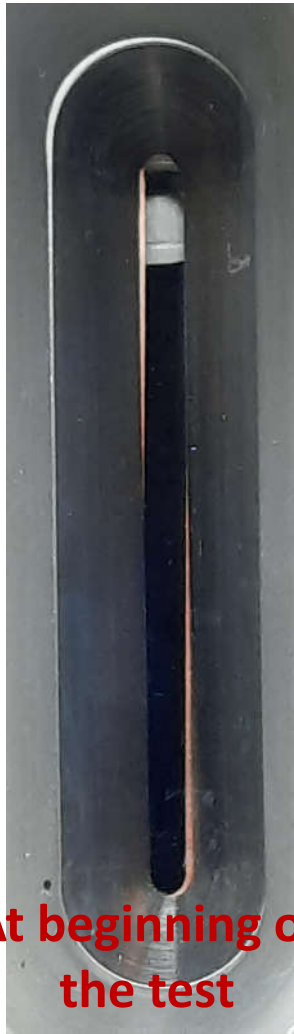
Ugnu oil samples,
Reservoir rock samples,
NGL (solvent),
Reservoir data
Polymer samples and advisory



Phased approach



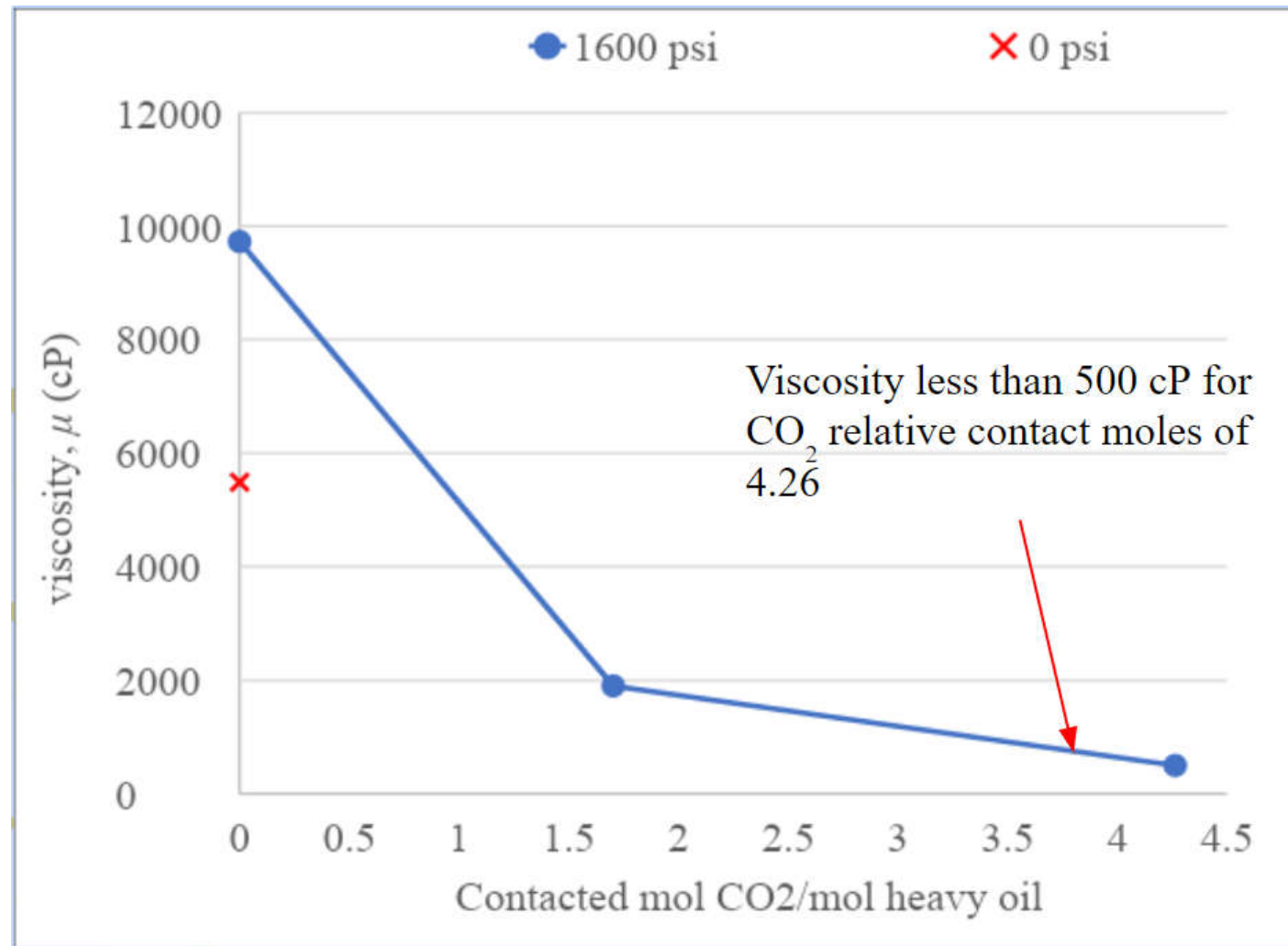
Effect of solvent (CO_2) on Ugnu oil



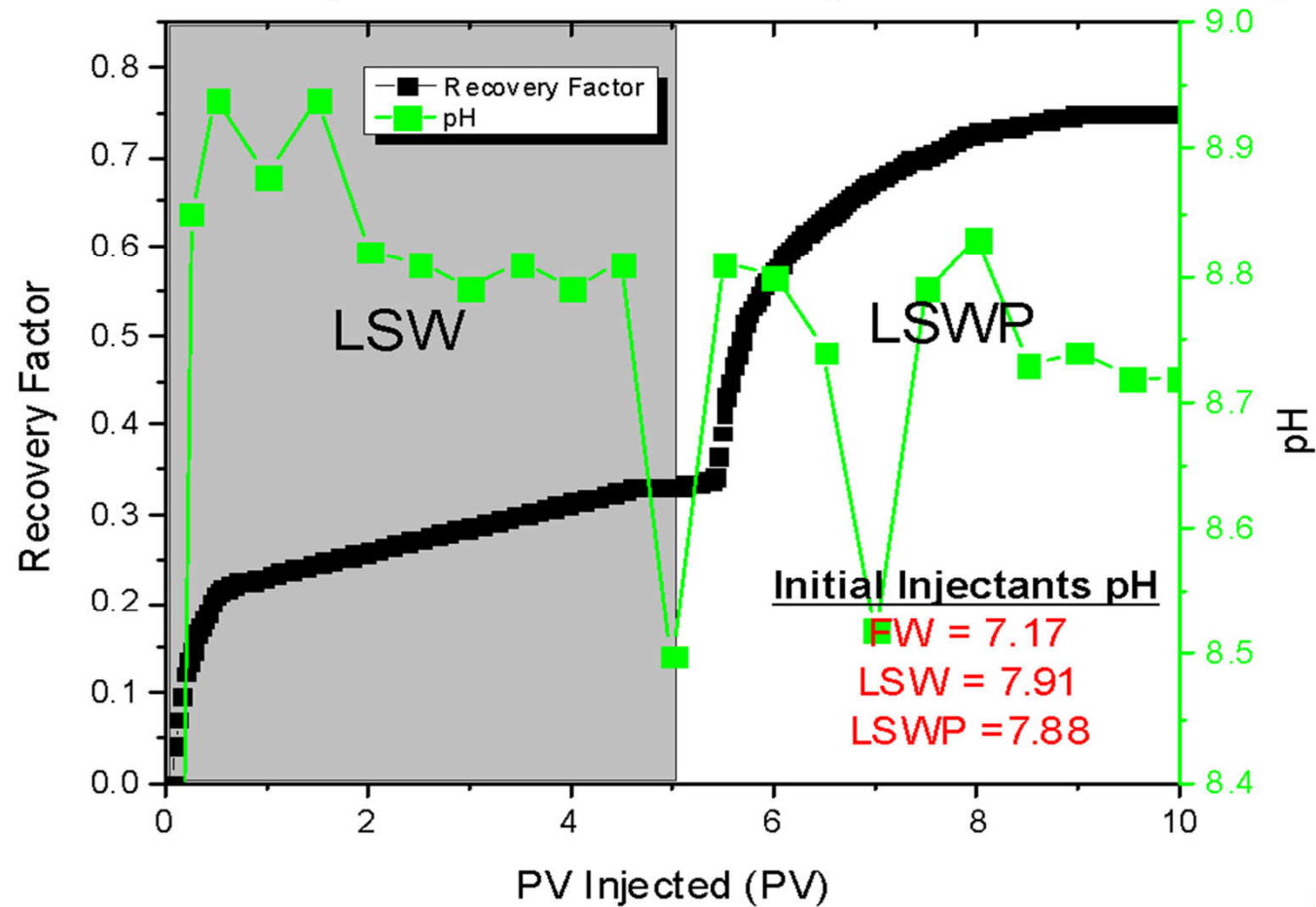
At beginning of
the test



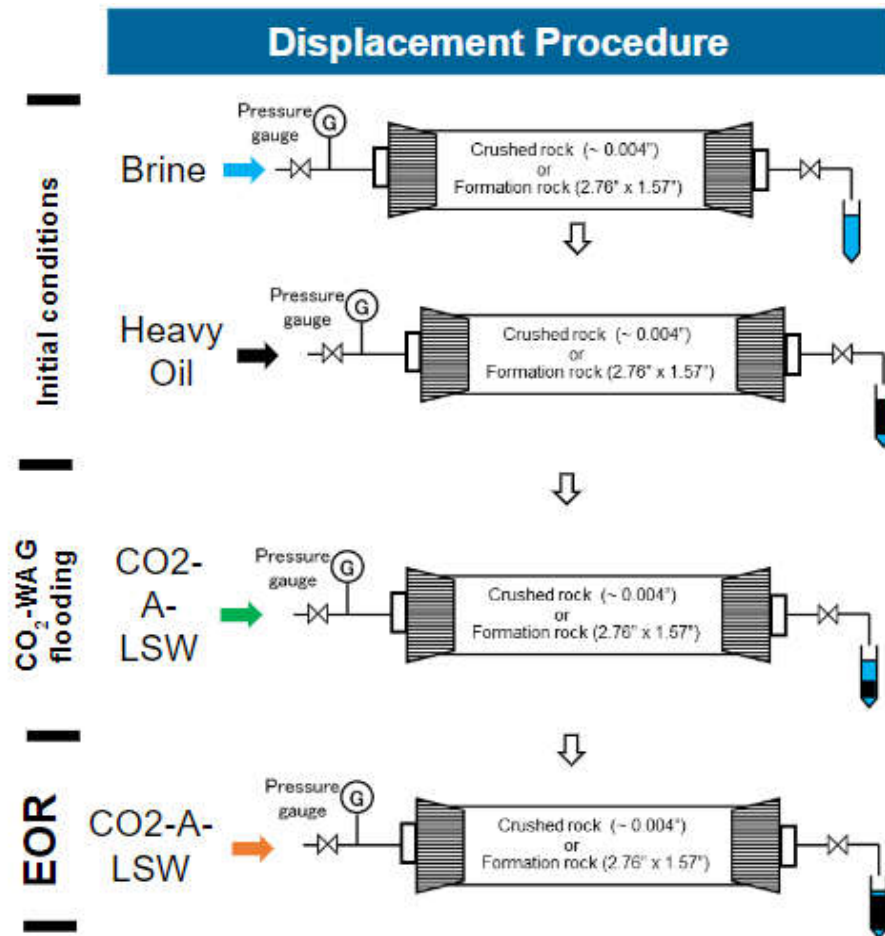
At end of
the test



Ugnu oil recovery – low salinity water and polymer



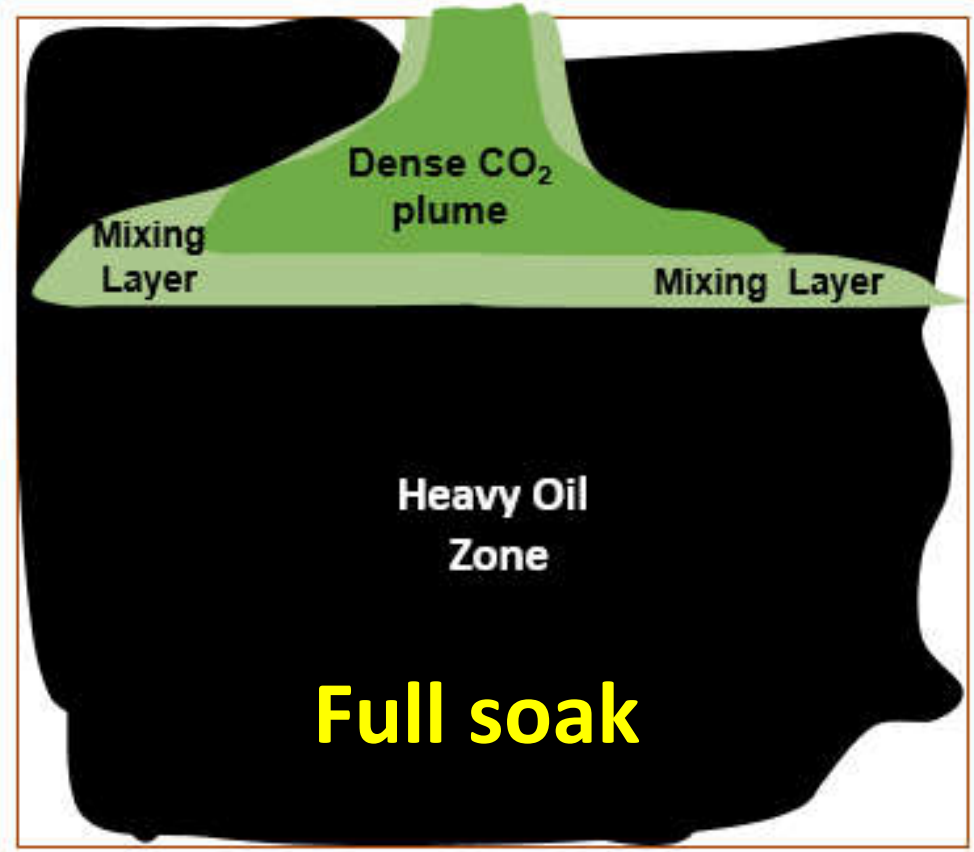
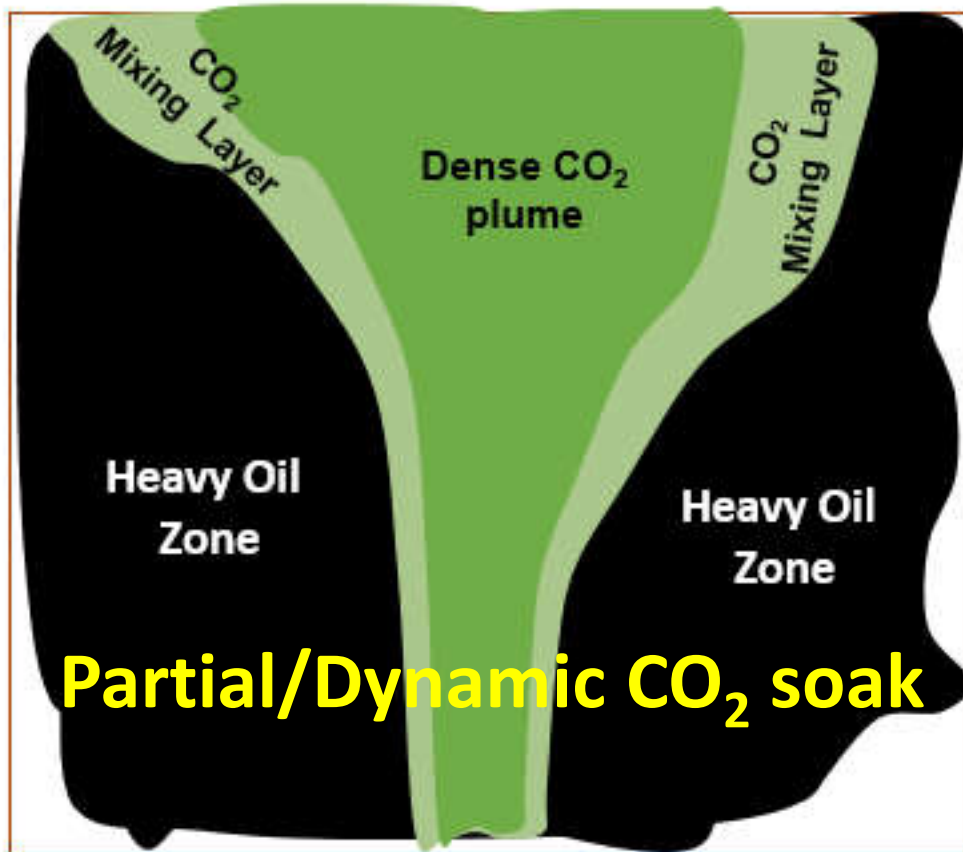
CO₂ solvent -> Low Salinity Water and/or CO₂ solvent -> Polymer injection *Alternating Cycles*



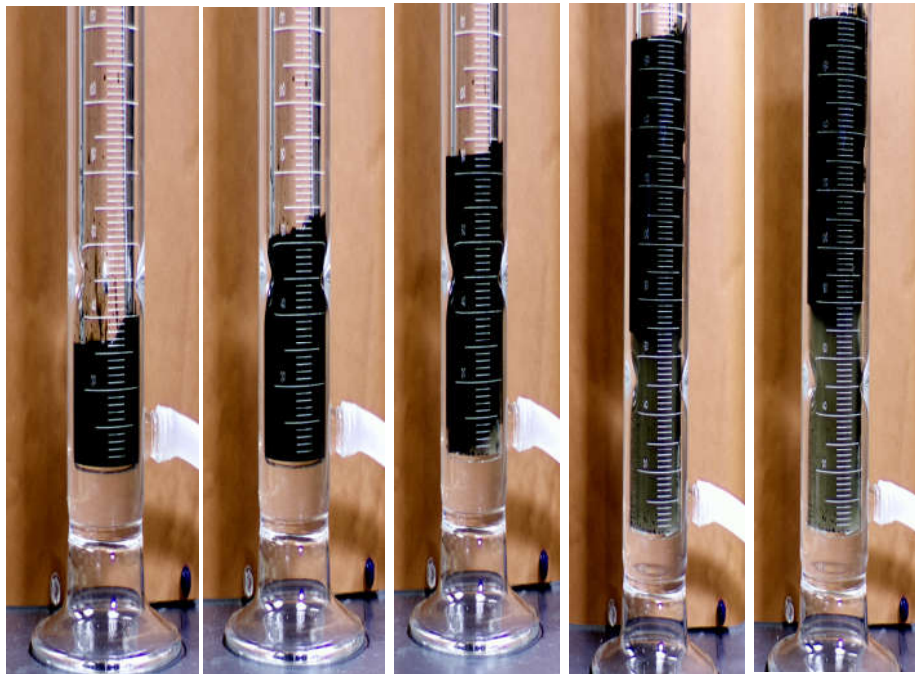
- Two different modes of CO₂ “soaking” followed by low salinity water
- Evaluate oil viscosity reduction/swelling
- Monitor gas, oil and water production
- Evaluate CO₂ “stored” while enhancing heavy oil recovery



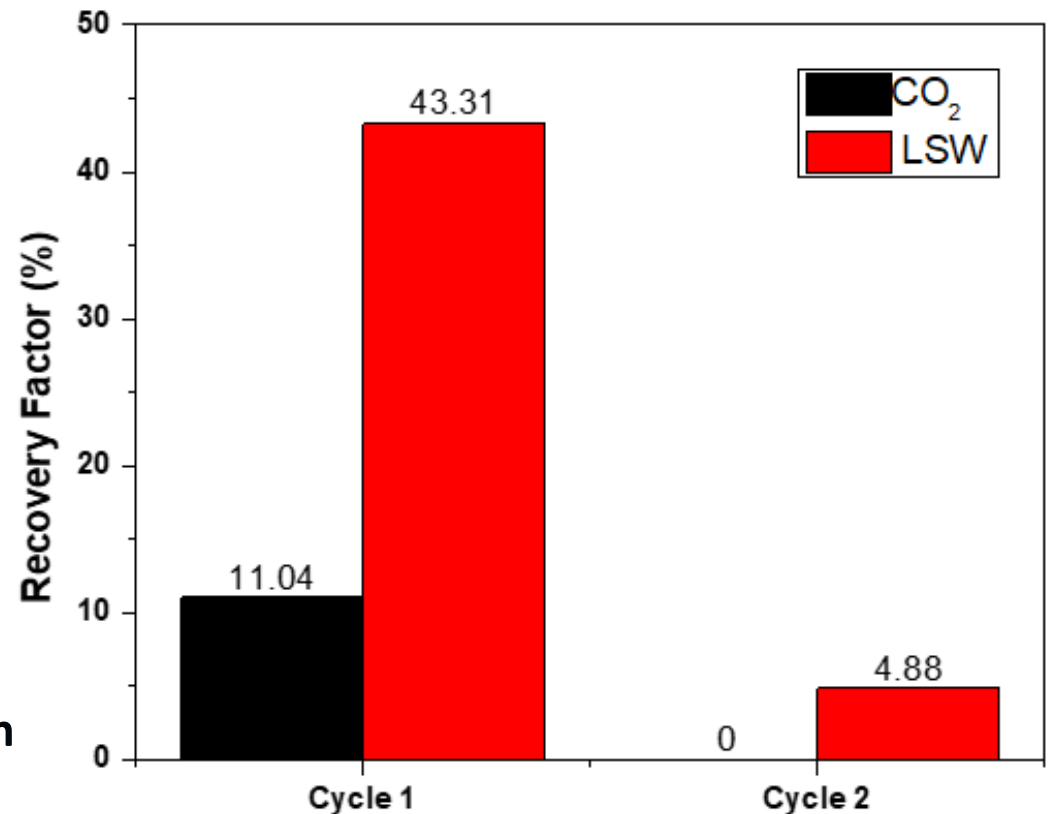
CO₂ interaction with Ugnu oil



Ugnu oil recovery: CO₂ – low salinity water alternating cycles



Collection of produced fluids during injection



Upcoming plans

- Continue working on all Phase I tasks so that enough data is generated for initial reservoir simulation – decision point
- A two-day forum/conference of academics (US and Canada), industry and SNF (polymer manufacturer) on heavy oil EOR at UAF after the SPE Western Regional Meeting to:
 - Discuss our currently ongoing projects and raise ideas on how to extend our current work
 - Visit our labs to know our capacity and capability
 - Discuss future potential collaborations in heavy oil EOR



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Number DE-FE0031606 AND
Governor Dunleavy, State of Alaska for the PAS project**



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