

Bakken Optimization Program (BPPOP) 5.0

Submitted by:

Energy & Environmental Research Center (EERC)

Principal Investigator: James Sorenson

- ☐ **Total Funding Request - \$6,000,000**
- ☐ **Total Project Costs - \$12,030,206**
- ☐ **Project Duration: 2 Years**

PROJECT DESCRIPTION

- The EERC proposes a 2-year program of activities—BPOP 5.0—that optimizes petroleum production in North Dakota. BPOP-5.0 is a continuation of the collaborative effort between the state of North Dakota, the petroleum industry, and the U.S. Department of Energy (DOE) to develop solutions to challenges in the Bakken.
- The objective is to provide technical tools that optimize oil production and lead to the broad deployment of technologies, including EOR and improved oil recovery, that enable continued sustainable development of North Dakota's vast Bakken resources
- The primary goals of the proposed BPOP 5.0 are to 1) provide the state and industry with science-based insight to maintain the economic sustainability of the Bakken play in North Dakota, with an emphasis on guiding industry to the next phase of Bakken play development through commercialization of EOR and application of emerging IOR technologies and 2) provide stakeholders with the knowledge needed to plan and implement innovative development strategies and reduce lease operating expenses that will add value to Bakken Tier 1, 2, and 3 acreages.

TECHNICAL REVIEWERS' RATING SUMMARY

Statement	Weighting Factor	<u>TR G-62-I1</u>	<u>TR G-62-I2</u>	<u>TR G-62-I3</u>	<u>Average Weighted Score</u>
Objectives	9	5	5	2	36
Achievability	7	4	4	5	28
Methodology	8	4	5	3	32
Contribution	8	5	5	3	32
Awareness/ Background	5	5	5	5	25
Project Management	3	3	5	3	9
Equipment / Facilities	2	4	3	2	6
Value/Industry- Budget	4	5	3	3	12
Financial Match – Budget	4	3	3	2	8
<i>Average Weighted Score</i>		219	223	159	200
<i>Maximum Weighted Score</i>				250 possible points	

TECHNICAL REVIEWER TOTALS

- G-62-I1

Average Weighted Score: **219 out of 250**

FUND

- G-62-I2

Average Weighted Score: **223 out of 250**

FUND

- G-62-I3

Average Weighted Score: **159 out of 250**

FUNDING TO BE CONSIDERED

TECHNICAL REVIEWER COMMENTS

Reviewer G-62-I1

Continuation of BPOP funding at the requested level is strongly recommended. BPOP 5.0's proposed outcomes align exceptionally well with the documented goals and objectives of the OGRC. Few OGRC programs have delivered as much long-term value to the state of North Dakota as the BPOP program, which has provided 11 years of impactful results. Based on the program's past successes, there is high confidence that the next round will generate another round of insights capable of again advancing Bakken development to the next level. In the near term, the greatest value will likely come from the expansion of economically viable drilling opportunities in the fringe (Tier 3) areas of the state, followed closely by the development of implementation strategies for improved oil recovery (IOR) and enhanced oil recovery (EOR).

Recommendation: FUND

TECHNICAL REVIEWER COMMENTS

Reviewer G-62-I2

Additional research goals of hydrogen sulfide source determination are needed, and research of the past history of Bakken production will show that this is not from the Bakken formation or Three Forks formations, and was never found in those reservoirs, until the advent of high injection rate and high slurry volume treatments. This points to out of zone vertical fracture growth, into the overlying sour intervals of the Madison, as the likely culprit. The extremely high salinity and elevated temperature of the produced water in the Bakken, particularly in the center of the Williston basin, is very inhibitive to reservoir bacteria growth. The solution is not likely to be found in fracturing fluid chemistry or biocides, but in actually paying attention of the plethora of micro-seismic data, fracture modeling with realistic geologic stress modeling that consistently show extreme vertical fracture growth. Tracer and temperature logs, run in the past on vertical Bakken completions, regularly showed vertical upward growth of at least 250' to 300', even in small 60,000 gal gelled oil treatments, pumped at 12 to 15 bpm. Another area that will likely rear its head once EOR injection begins, is the loss of hydraulic fracture proppant conductivity and fracture to wellbore connectivity due to high temperature degradation of the silica-based proppants, and the deposition of free salt in the proppant pack and fracture. A significant portion of the benefits of post injection treatments, with surfactants in freshwater or low salinity brines, is likely due to dissolution of salt deposits in the fracture, rather than solely wettability and capillary effects, particularly in the critical nearwellbore area where fracture geometry results in a convergent flow choking effect.

Recommendation: FUND

TECHNICAL REVIEWER COMMENTS

Reviewer G-62-I3

This proposal is the 5th iteration of a project that has been ongoing for over 12 years. The key points of research are definitely relevant to the current state of O&G in ND, and the nation overall, and are important to understanding how best to unlock future potential from mature plays. I do question why there needs to be a 5th iteration of the BPOP, as many of the focus areas are relatively standard analysis for operators in O&G basins, especially the large operators listed as partners. Therefore, I see this proposal as much more cultural than technical, meaning the key operators in ND are interested in partnering with current and future academia in hopes of securing relationships and networks within the State. There is no doubt that the literature produced by previous BPOP iterations have been useful to operators in the basin but the BPOP 5.0 proposal appears to be very vague in what it hopes to deliver, especially given that the 4.0 partners likely have invested significant effort into solving these problems internally for their localized plays. That said, this appears to be a longstanding partnership with the EERC, and UND, and I see no issues continuing the study as they are relevant challenges, however I would encourage the EERC to limit their focus to one or two key issues rather than tackling. Of note, DJ Basin operators partnered with Colorado School of Mines in a similar fashion and the project was very successful and was a cultural win for the State. I think these partnerships are important to link academia and industry together, but it is also important to keep an eye on your scope, lest you end up spending money recklessly.

Recommendation: Funding to be Considered

Director's Recommendation:

☐ Fund in the amount of \$4,000,000