



Bakken Production Optimization Program

BPOP PROSPECTUS



PROGRAM INTRODUCTION

Led by the Energy & Environmental Research Center (EERC), the highly successful Bakken Production Optimization Program (BPOP), funded by its partners and the North Dakota Industrial Commission through its Oil and Gas Research Program, is continuing for the time frame of 2023–2025. The goals of this research program, BPOP 4.0, are to provide the state and industry with science-based insight to maintain the economic and environmental sustainability of Bakken production in North Dakota. BPOP 4.0 will provide stakeholders with the knowledge needed to implement innovative development strategies that will enable the continued growth of production while reducing the carbon intensity of the Bakken play.

BPOP 3.0 INDUSTRY PARTNERS

This premier partnership program, recognized as an exemplary model by others nationwide, demonstrates that state lawmakers, state regulators, and industry can work together for positive results for shareholders and taxpayers alike. Project partners focus research on industry-driven challenges and opportunities. BPOP 3.0 industry partners included the following:

- Chord Energy
- ConocoPhillips
- Devon Energy
- ExxonMobil (XTO Energy)
- Hess Corporation
- Liberty Resources LLC
- Marathon Oil
- Petro-Hunt LLC



PAST BPOP ACHIEVEMENTS (2013–2023)

› DSU SETBACK RULES

To better describe the impact of proposed changes to setback rules on drilling spacing units (DSUs), BPOP refereed the performance of representative simulation cases by several operators. The EERC then coordinated an informative presentation to the state of North Dakota.

› LIBERTY'S EOR PILOT PROJECT, EAST NESSON SITE

The EERC, through BPOP, conducted laboratory, modeling, and field-based investigative activities in support of an enhanced oil recovery (EOR) pilot test in the East Nesson Field using produced gas injection with rapid pulses of water. Substantial incremental oil was produced as a result of the pilot test.

› CARBON INTENSITY TOOL

A carbon intensity analytical tool that provides information related to gas flaring, lease gas combustion, and tank vapors for selected wells (as selected by the tool user) was developed.

› WELL COMPLETION AND PRODUCTION DASHBOARD

The BPOP Analytics Well Completion and Production Dashboard was developed to provide partners with a real-time tool for analyzing production and completion data and calculating optimal completion parameters using machine learning.

› STUDY OF BAKKEN REFRACTURING

A review and statistical analysis of a data set of refractures conducted in 341 wells provided insight to help understand the impacts of different completion- and geology-related factors on short- and long-term oil production of refractured wells in the Bakken.

› FLARING REDUCTION

A flare reduction technology called Polar Bear™ was developed, providing a means to recover storage tank vapors. Polar Bear™ technology overcomes economic challenges by providing fit-for-purpose compression and vastly reducing the maintenance associated with traditional compression.

› 3-MILE LATERAL WELLS STUDY

The results of a study of 275 3-mile lateral wells support the continued development of the longer laterals that benefit operators through reduced costs and lower environmental impact.

› EVALUATION OF MECHANISMS OF BAKKEN WELL SOURING

The EERC research team identified several potential mechanisms of souring in the Bakken, including thermochemical sulfur reduction (TSR).

› BAKKEN GEOLOGIC CLUSTER ANALYSIS TOOL

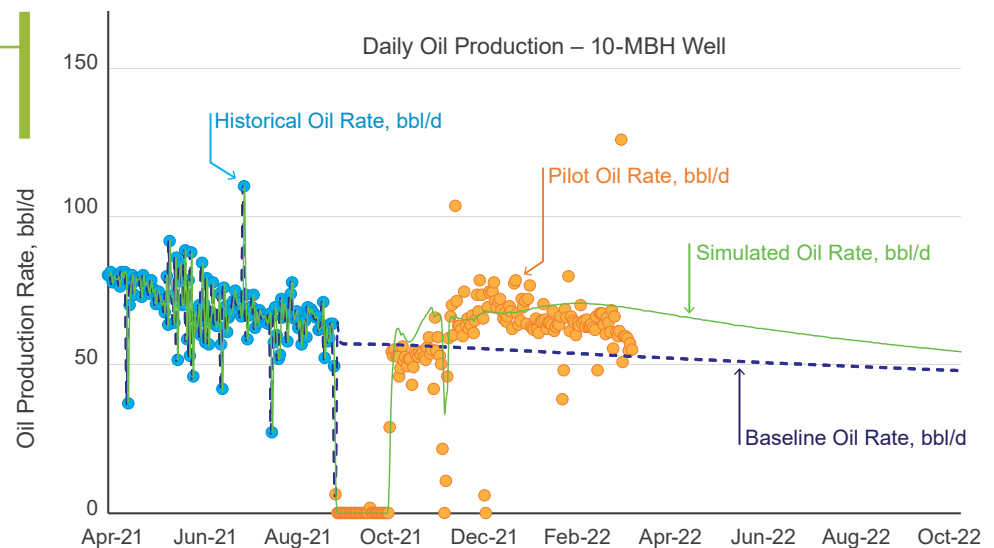
An interactive Bakken geologic cluster analysis tool was developed that allows users to divide the Bakken petroleum system (BPS) into subareas (clusters) based on geologic and fluid properties data to analyze a variety of drilling, completion, and production parameters using three different clustering algorithms.



BPOP 3.0 HIGHLIGHTS

In partnership with Liberty Resources, the EERC, and EOR ETC, an EOR pilot test was conducted in a single well in the East Nesson Field. This pilot used produced gas injection with rapid pulses of water. The pilot also used fresh water mixed with surfactant. The data generated by the pilot indicate that the injection cycle resulted in **the production of substantial amounts of incremental oil.**

Decline curve analysis indicates that approximately 8400 barrels (bbl) of incremental oil will be produced from two wells in the DSU (the injector and an offset well) over the course of 5 years.



ABBREVIATED LIST OF BPOP 4.0 ACTIVITIES

› EOR

Laboratory-, modeling-, and field-based activities will be conducted to develop knowledge and operational best practices that will support broad commercial implementation of EOR across the Bakken play with rich gas or CO₂.

› METHANE EMISSION MITIGATION AND FLARE REDUCTION

With support from BPOP partners, and cofunding of \$1 million from the U.S. Department of Energy, this effort will test Polar Bear™ technology in a relevant field environment to advance the technology readiness for broad field implementation. The objectives of the effort are to 1) develop and validate the Polar Bear™ technology to capture vapors from storage tanks to achieve zero or near-zero methane emissions; 2) complete engineering-scale testing of a prototype design functioning with anticipated gas components and at dynamic conditions to validate process controls, design parameters, and safety; and 3) advance the technology for field implementation.

› COMPLETION AND PRODUCTION DATA ANALYTICS

The EERC will continue to assess the impacts of different completion techniques and operational parameters on well and DSU performance, with the goal of identifying factors to optimize production. This activity will include the evaluation of geology and completion parameters such as DSU well count, lateral length, well spacing, treatment size, and completion type on oil, gas, and water production from hydraulically fractured and refractured wells.

› FLUIDS CHARACTERIZATION

Bakken fluids data collected by BPOP over 9 years have been used to identify and follow evolving trends in key basinwide performance indicators such as gas-oil ratio, oil-water ratio, and produced fluids compositions. Detailed fluids data generated under this task will be used in the completion and production data analytics task.

› GEOLOGIC AND PETROPHYSICAL EVALUATIONS

To support the optimization of well completions and EOR, the quality of reservoir and source rock within the BPS will be assessed through use of sequence stratigraphy techniques and advanced petrophysical analyses. Leveraging previously gathered core analyses and logs, wells will be evaluated for lithology, water saturation, kerogen volumes, permeability, and reservoir quality.

› UNDERSTANDING AND MITIGATING H₂S IN BAKKEN PRODUCTION STREAMS

Based on fundamental knowledge, the EERC will evaluate advanced concepts that can improve flow behavior and increase the efficiency of artificial lift.



MEMBERSHIP MODEL AND TIERS

Several leading Bakken producers enlisted as founding consortium members. Continued membership is now being actively solicited with annual contributions:

MAJOR PARTNERS

LARGE PRODUCERS
(150 wells or more)

\$100,000/yr

- ▶ Prerelease review of program products
- ▶ Participation in program-facilitated technical/policy forums
- ▶ Highlighted participation in public briefings
- ▶ Access to all program products via web page

MINOR PARTNERS

SMALL PRODUCERS
(fewer than 150 wells)

\$50,000/yr

- ▶ Limited direction of program activities
- ▶ Participation in program-facilitated technical/policy forums
- ▶ Highlighted participation in public briefings
- ▶ Access to all program products via web page

ASSOCIATE MEMBERS

SERVICE COMPANIES AND
NONOPERATING PRODUCERS

\$25,000/yr

- ▶ Participation in program-facilitated technical/policy forums
- ▶ Access to all program products via web page

BAKKEN PRODUCTION OPTIMIZATION PROGRAM WEBSITE

- ▶ The BPOP WEBSITE can be accessed at undeerc.org/Bakken/Optimization
- ▶ A key feature of the site is ACCESS TO ALL BPOP PRODUCTS through the Search Documents feature. All products are accompanied by a public abstract.
- ▶ Free, publicly available products are AVAILABLE FOR DOWNLOAD by all.
- ▶ Premium products are available EXCLUSIVELY TO PARTNERS for 15 months prior to public release.



Bakken Production Optimization Program

To discuss consortium membership, contact:

James A. Sorensen

Director of Subsurface R&D
701.777.5287 | jsorensen@undeerc.org

John A. Harju

Vice President for Strategic Partnerships
701.777.5157 | jharju@undeerc.org

Energy & Environmental Research Center

University of North Dakota
15 North 23rd Street, Stop 9018
Grand Forks, ND 58202-9018
701.777.5000 | research@undeerc.org | www.undeerc.org

