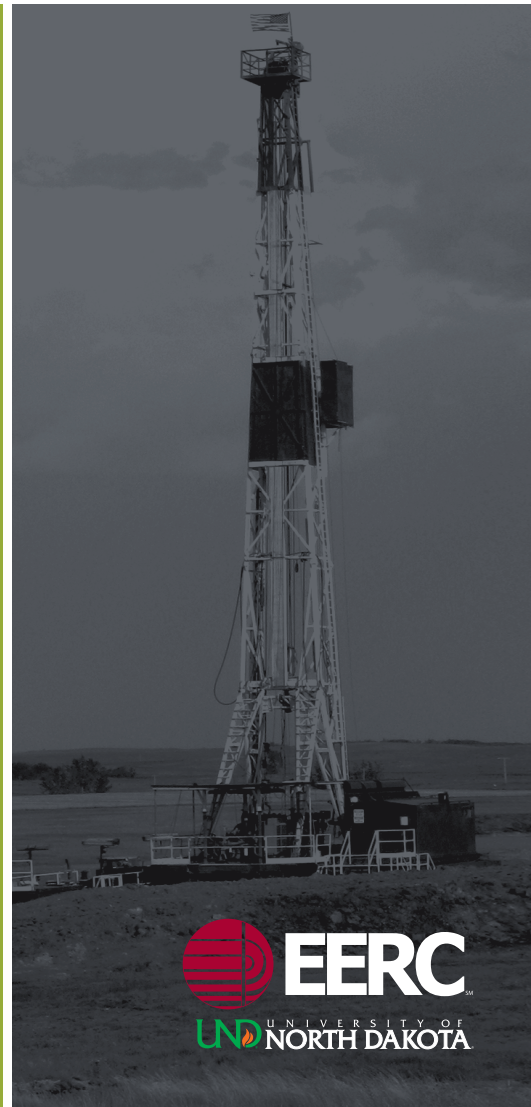




Bakken Production Optimization Program

# BAKKEN PRODUCTION OPTIMIZATION PROGRAM 2.0 PROSPECTUS



## PROGRAM INTRODUCTION

Led by the Energy & Environmental Research Center (EERC), the highly successful Bakken Production Optimization Program (BPOP), funded by its members and the North Dakota Industrial Commission, is continuing for the time frame of 2017–2020. The goal of this research program, BPOP 2.0, is to improve Bakken system oil recovery and reduce its environmental footprint. The results of the 3-year program will increase well productivity and the economic output of North Dakota's oil and gas resources, decrease environmental impacts of wellsite operations, and reduce demand for infrastructure construction and maintenance.

## BPOP 1.0 PARTNERS

A premier partnership program was recently completed which has been cited as an exemplary model by others nationwide. It has demonstrated that state lawmakers, state regulators, and industry can work together for positive results for shareholders and taxpayers alike. Phase I partners focused research on industry-driven challenges and opportunities.

Continental Resources, Inc.  
Marathon Oil Corporation  
Whiting Petroleum Corporation  
North Dakota Oil and Gas Research Program  
ConocoPhillips Company  
Nuverra Environmental Solutions  
Hitachi  
Hess Corporation  
Oasis Petroleum, Inc.  
SM Energy  
XTO Energy, Inc.



## BPOP 1.0 ACHIEVEMENTS (2013–2016)

### Continental's Hawkinson Project

Aimed at significantly increasing total production and production rates from North Dakota oil wells where oil reserves of the second and third benches of the Three Forks Formation, located just below the Bakken oil formation, are being explored.

### Flaring Reduction

As the Flaring Task Force formulated a multistage plan to decrease flaring rates, BPOP provided flaring statistics analysis that served as the foundation for these plans. The BPOP team presented the resulting plan to the governor in January 2014.

### TENORM Disposal

To address TENORM (technologically enhanced naturally occurring radioactive material) disposal, BPOP representatives served as subject matter experts and advisors to the North Dakota Petroleum Council's NORM Task Force and to state interests.

### Spills Remediation

In partnership with BPOP, North Dakota State University, the Saltwater Spills Task Force, and industry, the "Spills Primer" and the "Remediation Resource Manual" were created.

### Water Use and Handling Forecast

A summary of trends in the Bakken, an estimation of future demand/disposal needs, an overview of treatment technologies, recycling/reuse considerations, and a summary of implications for BPOP partners were created.

### DSU Setback Rules

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

### Crude Oil Volatility

U.S. Department of Energy-commissioned study to investigate crude oil properties related to safe handling and transport.

### Technical Forums for Industry

BPOP provided a regular forum for peer-to-peer technical discussions on issues affecting all members. Many members commented that this function is available nowhere else.

### Myth Busting and Education

Correcting public misinformation on TENORM, saltwater spills, flaring statistics, water use, crude oil volatility, and other topics through a BakkenSMART fact sheet series.

## ABBREVIATED LIST OF BPOP 2.0 ACTIVITIES\*

- › **Rich-Gas Enhanced Oil Recovery (EOR)** – Develop understanding of reservoir interactions to reduce flaring and improve ultimate recovery.
- › **Refrac Optimization** – Facilitate industry forums on refrac selection criteria, execution, and evaluation.
- › **Produced Fluid Characterization** – Collect and analyze data on crude oil, associated gas, and produced water to gain a better understanding of the resource and support facilities process modeling and reservoir modeling.
- › **Fugitive Emissions** – Inform industry and the state on the evolving emission regulatory picture, available emission measurement technologies, and available emission control technologies.
- › **Reservoir Performance Modeling** – Identify key reservoir and well performance metrics to enable better planning of surface facility development.
- › **Water Injection Reservoir Assessments** – Identify key reservoir and well performance metrics to enable better planning of surface facility development.
- › **Facility Process Modeling** – Develop a foundational tool for holistic examination of the coupled effects of several operations variables (produced fluid composition, climate, processing equipment, operating conditions, equipment suite designs, etc.) on fugitive emissions, crude oil properties, and equipment performance.
- › **Aromatic/Aliphatic Study** – Evaluate oil composition as a tool to identify the source of produced oil and improve the understanding of oil recovery.
- › **Member-Driven Activities** – Evaluate other topics identified by our partners.

## FOCUS ON RICH GAS EOR AT LIBERTY RESOURCES' OIL FACTORY

This project represents a methodical, structured approach to oilfield development, promoted by Liberty Resources. The approach is centered on design of a system of wellsites, rather than a site-by-site approach to development of a particular oil field. Liberty Resources believes this has potential to maximize oilfield and DSU productivity and minimize environmental impact associated with petroleum production.

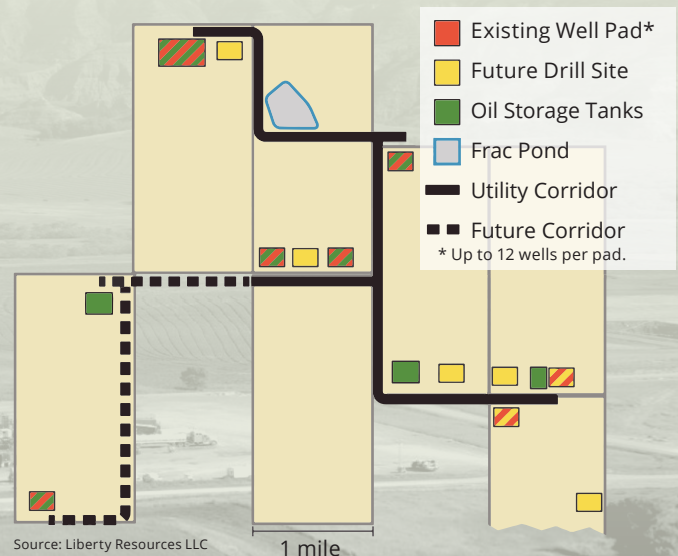
The approach coincides perfectly with BPOP 2.0's stated intention to employ a systems approach to enhance overall production efficiency, recognizing that improved coordination among various design factors (reservoir management, well design, surface processing, gas management, waste management) can lead to significant improvements in resource recovery efficiency.

### BUILDING AN OIL FACTORY

Instead of drilling wells on an ad hoc basis, Liberty Resources is developing a 96-well North Dakota complex called Stomping Horse in a methodical manner to reduce costs. The company has built a "utility corridor" that connects and services the well pads, reducing the need for heavy truck traffic and long runs of pipeline to isolated units.



- › **A network** of pipe will collect the natural gas for sale; an oil pipeline will gather the oil.
- › **Natural gas** will also be captured and piped around the project to power drilling rigs and other equipment.
- › **Water for hydraulic fracturing** operations in the 96 wells will come from a single "frac pond" connected by pipeline to the well pads.
- › **A saltwater disposal** well will take wastewater via pipeline from oil extraction operations.



\* Activities are member-driven.

## 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
- › Participate 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
- › Participate 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**

- › Participate in program-facilitated technical/policy forums
- › Access to all program products via Web page

## BPOP 2.0 PARTNERS AS OF JULY 2018



### To discuss consortium membership, contact:

**John A. Harju**, Vice President for Strategic Partnerships,  
701-777-5157, jharju@undeerc.org

**Charles D. Gorecki**, Director of Subsurface R&D,  
701-777-5355, cgorecki@undeerc.org

### Energy & Environmental Research Center

University of North Dakota  
15 North 23rd Street, Stop 9018  
Grand Forks, ND 58202-9018

[www.undeerc.org](http://www.undeerc.org)

