



Energy & Environmental Research Center

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August 15, 2025

Mr. Jordan Kannianen
Deputy Executive Director
North Dakota Industrial Commission
ATTN: Oil and Gas Research Program
State Capitol – 14th Floor
600 East Boulevard Avenue, Department 405
Bismarck, ND 58505-0840

Dear Mr. Kannianen:

Subject: EERC Proposal No. 2025-0160 Entitled "Bakken Production Optimization Program (BPOP) 5.0" in
Response to the North Dakota Industrial Commission Oil and Gas Research Program Solicitation

The Energy & Environmental Research Center (EERC) is pleased to propose a continuation of a well-established research program that encourages and promotes the use of new technologies that have a positive economic and environmental impact on oil and gas exploration and production in North Dakota.

The \$100 application fee for this proposal is provided through ACH Transaction No. 292188. The EERC, a research organization within the University of North Dakota, an institution of higher education within the state of North Dakota, is not a taxable entity; therefore, it has no tax liability.

This transmittal letter represents a binding commitment by the EERC to complete the project described in this proposal. If you have any questions, please contact me by telephone at (701) 777-5287 or by email at jsorensen@undeerc.org.

Sincerely,

DocuSigned by:

A stylized signature of Jim Sorensen in black ink.

0671D00C8437443...

James A. Sorensen

Director of Subsurface Research and Development

Approved by:

DocuSigned by:

A stylized signature of Charles D. Gorecki in black ink.

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Charles D. Gorecki, CEO
Energy & Environmental Research Center

JAS/kal
Attachment

c/att: Erin Stieg, North Dakota Industrial Commission

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PROJECT DESCRIPTION

The Energy & Environmental Research Center (EERC) proposes to provide industry and the state of North Dakota with technical support to drive innovation that facilitates production of the next 5 billion barrels of oil from the Bakken through the development and testing of technologies under the existing and highly successful North Dakota Industrial Commission (NDIC) Oil and Gas Research Program (OGRP)-sponsored Bakken Production Optimization Program (BPOP). 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. A summary of accomplishments over the past 11 years of BPOP are provided in Appendix A.

Industry and state stakeholders have expressed a desire to maximize the productivity of wells and drilling spacing units (DSUs), increase the ultimate recovery of oil, and reduce the carbon intensity of Bakken operations. Stakeholders are interested in optimizing and improving primary production throughout the Bakken play, determining how to best move into secondary production through implementation of commercial-scale enhanced oil recovery (EOR) and improved oil recovery (IOR) technologies, reducing flaring and fugitive methane emissions, mitigating well souring, and improving operational efficiencies. Building on lessons learned from BPOP involvement in recent EOR pilots with Liberty Resources, BPOP 5.0 will include participation in a large-scale pilot being conducted by Chord Energy with cost-share from DOE. North Dakota's industry is capturing gas at levels that exceed goals set by the Department of Mineral Resources in 2014. However, the goal to eliminate flaring in North Dakota is yet to be achieved. BPOP research has enabled the creation of new gas capture technology that makes it affordable to capture the remaining flared volumes in North Dakota. BPOP 5.0 intends to continue the flare reduction work by conducting field pilots in the next phase with the support of DOE. The industry is quickly changing, with more economic completion practices, including 3- and +4-mile laterals and wells

- Evaluation of emerging drilling and completion techniques such as the use of J- and/or U-shaped wells, and alternative completion and stimulation technologies to improve and optimize the efficiency of primary production.

Goals and Objectives: 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.

Methodology: BPOP 5.0 will span multiple technical topic areas as state and industry priorities dictate. The flexibility of the stakeholder-driven program will provide the ability to address emerging issues as needed. Through BPOP 5.0, the EERC will continue to serve existing and new North Dakota Petroleum Council (NDPC) task force groups established to address challenges to improve oil recovery, optimize production strategies, mitigate reservoir souring, and inform EOR efforts. The EERC is committed to coordinating with other state-funded EOR pilots awarded under the Enhanced Oil Recovery Grant Program, authorized in 2025 by Senate Bill No. 2014, to ensure quality datasets and findings are documented and disseminated. The primary research topic areas are described below.

Bakken Enhanced Oil Recovery: Recent work has highlighted North Dakota’s significant potential of EOR. Successful application of EOR technologies can unlock billions of barrels of untapped oil, generating substantial revenue. Under BPOP 5.0, the EERC will build on insights from previous Bakken EOR pilot studies, simulations, and data analytics to determine a pathway to commercial implementation across the basin. Efforts will include laboratory experiments, modeling, and field activities to be conducted under the DOE-funded BCO₂EORFL, including a cumulative 18-month injection as part of a commercial-scale pilot being conducted by Chord Energy, currently planned for 2026–2027. These efforts will include

Completion and Production Data Analytics: The EERC will evaluate the influence of completion techniques and operational parameters on well and DSU performance to determine optimal production strategies. This includes assessing geologic context and variables such as well count per DSU, lateral length, spacing, treatment size, and completion type. Leveraging ML and AI, the analysis will uncover DSU-, field-, and basin-wide trends, informing data-driven recommendations for infill (child) well designs, parent well management strategies, and EOR approaches. While previous phases focused on Tier 1 and 2 acreage, BPOP 5.0 will use ML and AI to also assess development potential in Tier 3 areas. The EERC will work with Virginia Tech Applied Research Corporation (VT-ARC) to apply the latest advances in AI/ML technologies and methods to BPOP data analytics activities. These efforts will identify and prioritize the most impactful potential AI/ML application opportunities in the Bakken. The results of these activities will enable stakeholders to optimize a variety of exploration, development, and production aspects of the Bakken play.

H₂S Investigation: H₂S is an undesirable by-product of oil and gas production in some Bakken wells. Previous BPOP research utilized laboratory analysis, data analytics, and reservoir simulations to identify mechanisms of H₂S generation. Building on this foundation, the EERC will integrate geology, geochemistry, data analytics, and completion simulations to refine strategies for identifying, managing, and mitigating the risk of H₂S generation (reservoir souring).

Reservoir Characterization: To support the evaluation of well completions, EOR, and data analytics, the EERC will conduct reservoir quality assessments of the Bakken petroleum system through sequence stratigraphic and advanced petrophysical analyses. The EERC will continue to build the database of petrophysical interpretations of both high-tier (e.g., spectroscopy and nuclear magnetic resonance logs) and common geophysical well-logging data suites. Leveraging insights from our existing ML analysis, petrophysical interpretations will target production drivers for Tier 2 and 3 acreage. This task will also include efforts by the University of North Dakota's Harold Hamm School of Geology and Geological

industry. BPOP efforts to date are summarized in Appendix A. It is anticipated that similar progress can be made on critical topics such as EOR, IOR, future resource development strategies, H₂S mitigation, and other topics over the next 2 years.

STANDARDS OF SUCCESS

Success will be measured in the program's ability to address the oil and gas industry's critical issues as identified by OGRP and BPOP partners, ultimately resulting in more efficient resource development and cost savings. Developing options to help ensure the success of the oil and gas industry in North Dakota while conserving the state's resources leads to a strong state economy and the creation of jobs to support all aspects of oil and gas development. Annual meetings with OGRP and BPOP partners will be held as a measure of success to discuss project status and gather feedback and guidance. Success will also be measured by delivery of high-impact products to state and industrial stakeholders.

The current OGRP-approved process of reporting will be employed to deliver results. This program provides partners premium access to reporting of results from activities for a period of 12 months following review by select partners prior to release to the public on the BPOP website. Products will be prepared on specific topics to be determined based on partner guidance. Select products, as determined by BPOP partners, may be released after shorter review periods if early release is deemed to be of greater advantage to the partners. High-level progress updates will be provided in quarterly or biannual reports, in an executive summary format, to OGRP for inclusion on the OGRP website for immediate access by the public. An annual briefing to OGRP will highlight the successes of BPOP and next steps. A final report summarizing program achievements and challenges will be prepared. Presentations at technical conferences and public outreach events will cover pertinent topic areas.

BACKGROUND/QUALIFICATIONS

The EERC is a nonprofit branch of the University of North Dakota. Resumes of key personnel are provided in Appendix C. James Sorensen, Director of Subsurface Research and Development, will serve

Bakken Production Optimization Program (BPOP) 5.0																											
Task Title		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
Task 1.0 – Project Management and Planning		D1 ▼				D2 ▼				D3 ▼				D4 ▼													
Website Maintenance																											
Task 2.0 – Bakken Enhanced Oil Recovery (EOR)																											
Bakken CO ₂ EOR Field Lab – Pilot Support Activities																											
Task 3.0 – Bakken Improved Oil Recovery (IOR)																											
Task 4.0 – Coordination with State Funded EOR Pilots																											
Task 5.0 – Completion & Production Data Analytics																											
Benchmarking of Lease Operating Expenses																											
H ₂ S Investigation																											
Innovative Completion Designs and Wellbore Architectures																											
Task 6.0 – Reservoir Characterization																											
Task 7.0 – Innovative Gas Capture Technologies																											
Polar Bear Technology Deployment and Testing																											
Deliverables																											
D1 – Biannual Progress Report Submitted																											
D2 – Biannual Progress Report Submitted																											
D3 – Biannual Progress Report Submitted																											
D4 – Final Technical Report Submitted																											

Figure 1. Preliminary program timetable.

BUDGET

The total estimated cost for the proposed effort is \$12,030,206. \$6,000,000 is requested from OGRP (\$3,000,000/year). Cost share will include \$3,305,774 cash from DOE (DOE Award No. DE-FE0032514) and \$1,144,432 cash from DOE (DOE Award No. DE-FE0032543). It is estimated that industry partners will provide a minimum of \$1,200,000 in cash cost share. Support from at least five companies is anticipated, including Chord Energy, ConocoPhillips, Devon, XTO Energy, and Petro-Hunt, which all supported BPOP 4.0. This group includes five of the top oil producers in North Dakota, and their operations cover most of the Bakken play area (Appendix B). Chord Energy will provide in-kind cost share at a minimum value of \$380,000. A portion of the budget will be allocated for meals provided as appropriate to support engagement and collaboration. Letters of support and a DOE letter of award for BCO₂EORFL can be found in Appendix D. The budget shown in Table 1 is based on previous EERC experience with the program. Budget notes can be found in Appendix E.