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November 1, 2024

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

Dear Mr. Haase:

Subject: Proposal Entitled “Maximizing Lateral Well Oil Production from Conventional Carbonate Mission Canyon Reservoirs in North Dakota”

Cobra Oil & Gas Corporation (Cobra) is pleased to submit the subject proposal to the Oil and Gas Research Program. This proposal will further investigate Wayne Field reservoir characterization and historical production analysis and explore field methods, downhole redesign, and redevelopment strategies to maximize oil recovery from the horizontal wells within the Mission Canyon Formation of the Wayne Field, North Dakota. The project will use new and existing well log and core data coupled with geological computer modeling and historical production analysis to design and implement field-scale strategies that will develop and optimize production from oil reservoirs observed to have water coning behavior in the Madison Group’s Mission Canyon Formation.

The \$100 application fee was shipped to the North Dakota Industrial Commission through UPS on October 31, 2024, tracking number 1Z7804750159694803. Cobra is committed to completing the project as described in this proposal. If you have any questions, please contact me by telephone at (940) 716-5100 or by email at kgardner@cobraogc.com.

Sincerely,

A handwritten signature in black ink that reads "Kyle Gardner".

Kyle Gardner
Vice President – Engineering
Cobra Oil & Gas Corporation

KG/bjr

Attachments

Oil and Gas Research Program
North Dakota
Industrial Commission



Application

Project Title: Maximizing Lateral Well Oil
Production from Conventional Carbonate
Mission Canyon Reservoirs in North Dakota

Applicant: Cobra Oil & Gas Corporation

Principal Investigator: Kyle Gardner

Date of Application: November 1, 2024

Amount of Request: \$1,000,000

Total Amount of Proposed Project: \$2,000,000

Duration of Project: 2 years

Point of Contact (POC): Kyle Gardner

POC Telephone: (940) 716-5100

POC Email Address: kgardner@cobraogc.com

POC Address: PO Box 8206
Wichita Falls, TX 76307

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ABSTRACT

Objective: Cobra Oil & Gas Corporation (Cobra) is seeking funding for a research project to maximize recovery of stranded reserves through the implementation of downhole equipment of a horizontal well within the Mission Canyon Formation of the Wayne Field, Bottineau County, North Dakota. The goal of the project is to optimize the production of oil from a conventional reservoir through the design and implementation of downhole technology to better control the production of fluids along the length of lateral wellbores. This goal will be accomplished in the Wayne Field through the following objectives: 1) the evaluation of existing and newly collected data from the field through detailed reservoir characterization and production analysis and 2) the design, installation, and pilot-scale testing of a production liner equipped with multiple mechanically actuating production sleeves isolated with stages of openhole packers within a horizontal well to produce stranded reserves. The development and implementation of strategies to produce additional economic volumes of oil from North Dakota's vast Mission Canyon carbonate play will have significant economic and social benefits to the state, municipalities, citizens, and industry.

Expected Results: The expected results will be a pilot-scale installation and testing of downhole equipment to isolate stages within a horizontal well to produce stranded reserves. Along with the pilot testing, characterization and production analysis of the Mission Canyon Formation within the Wayne Field will be completed to identify production drivers and reservoir conditions to identify other potential horizontal candidates. Learnings from this project will establish baseline operational strategies for oil production from the resource-rich Mission Canyon throughout the Williston Basin.

Duration: The anticipated project duration is 24 months (April 1, 2025, to March 31, 2027).

Total Project Cost: The total project cost is \$2,000,000. Cobra is requesting \$1,000,000 from the North Dakota Industrial Commission (NDIC) Oil and Gas Research Program. Cobra is providing \$1,000,000.

Participants: Cobra Oil & Gas Corporation and the Energy & Environmental Research Center at the University of North Dakota.

PROJECT DESCRIPTION

The Madison Group in North Dakota is a mature carbonate play that has produced nearly 1 billion barrels (Bbbl) of oil from ~6000 wells. Typically, the Madison Group (i.e., Mission Canyon Formation) has been bypassed historically because of higher water saturations. Total remaining oil-in-place reserves for the formation are estimated at up to 500 million barrels (Burton-Kelly and others, 2018). Conventional carbonate reservoir oil fields, such as Mission Canyon fields, can exhibit water coning behavior, where water preferentially flows from a deeper source causing oil to be bypassed. The stranded oil within reservoirs from water coning requires characterization of the field and unique production strategies to produce the trapped oil. The hypothesis of this project is that the implementation of downhole equipment to isolate production along Mission Canyon lateral wells can lead to improved oil production, resulting in greater ultimate recoveries from wells located in this oil play.

The Wayne Field was discovered in 1957 and produces oil from the Wayne interval of the Mission Canyon Formation. Wells were originally developed vertically, and after producing 160,000 bbl of oil, increased water cuts led to the field's first abandonment in 1986 despite redevelopment efforts from 1977 to 1985 (Jarvie, 2022). During 1994 and 1995, six horizontal wells were drilled to drain the reservoir more effectively and help minimize the effects of water production (Jennings and Johnson, 1996, Jarvie, 2022). Over time, production from these horizontal wells also declined, likely because of the strong water drive and water coning behavior, stranding oil within the reservoir.

In January 2024, Cobra Oil & Gas Corporation (Cobra) leased, bonded, and assumed operations of 11 orphaned wells (seven horizontal and four vertical) within the Wayne Field from the State of North Dakota that had been idle since 2020. During the shut-in period from 2020 to 2024, water cones are believed to have relaxed and dropped. When brought back online, some of the wells yielded larger oil cuts and greater oil production volumes than existed pre-abandonment. For the first 10 months of production at Wayne Field, Cobra observed a 20% increase in oil production, with oil cut increasing 10% over 2020 production records. Some individual wells are producing with oil cuts equivalent to 2020, but with 300% increases to oil production. Since January 2024, Cobra routinely acquired acoustic backside

fluid levels of each producing well as a proxy to monitor reservoir pressure and reservoir deliverability. Monitoring well conditions is critical to optimizing production from reservoirs undergoing water coning behavior.

Previous studies have demonstrated the potential of enhanced oil recovery (EOR) as a viable method to increase oil production an additional 60–90 million barrels of oil from the stranded oil of the Mission Canyon Formation throughout North Dakota (Dotzenrod and others, 2017; Burton-Kelly and others, 2018). The history of the Wayne Field demonstrates that mitigation of water coning behavior provides success in accessing stranded oil. This project entails characterization of the Wayne Field and implementation and demonstration of downhole equipment to redevelop horizontal wells and significantly improve access to the stranded oil of the Mission Canyon.

Objectives: Cobra is seeking to further investigate approaches and strategies to maximize oil recovery within Mission Canyon fields in western North Dakota. To mitigate the observed water coning behavior of lateral wells in the Wayne Field, a pilot project is proposed to implement mechanically actuating sleeves within a horizontal well to allow for production isolation and test if additional stranded resources can be accessed. To test this and other possible operation and completion strategies, Cobra will subcontract with the Energy & Environmental Research Center (EERC) at the University of North Dakota (UND) to evaluate existing data from the project field through detailed reservoir characterization and production analysis. The EERC has previous experience evaluating the recoveries of stranded oil and increasing recoveries in the Williston Basin (Dotzenrod and others, 2017; Burton-Kelly and others, 2018). Currently, Cobra and the EERC are in the process of completing Oil and Gas Research Program (OGRP) contract G-058-114 “Maximizing Production from Residual Oil Zones in Western North Dakota.” Production histories of some wells in the project demonstrated water coning behavior similar to the wells of Wayne Field. The Wayne Field lateral wells provide an opportunity to test hypotheses for the water coning in the Mission Canyon that may have implications for other similar fields. The end goal of the pilot test is to determine the viability of a downhole production isolation technology coupled with operational strategies for stimulating oil production in the Mission Canyon Formation.

Methodology: This project will incorporate data gathering and processing, petrophysical analysis of the existing geophysical logs and core, geological modeling, production analysis, downhole log data collection, and equipping a lateral section of a well with multiple stages of mechanically actuating sleeves. Data analysis from the field and well will be used to determine optimized operations and completion strategies for production for other similar Mission Canyon lateral wells and development plans for similar producing fields. The work will be conducted over five tasks leading to the successful completion of the stated project goal. Tasks 1–3 will be led by the EERC, which has demonstrated experience relevant to each of the tasks. The EERC’s letter of support is found in Appendix A. Tasks 4–5 will be led by Cobra. Specific activities under each task will be conducted and are defined in the following.

Task 1 – Data Assembly: The EERC will work with Cobra on data assembly and task auditing to identify knowledge gaps, including data necessary for subsequent tasks. Activities in this task include a core description workshop for Wayne and other nearby fields to determine the need for additional analyses of existing core, collection of public and Cobra-released well data (e.g., well logs, core analysis, production data, fluid characterization, well histories), and review of assembled data for gap analysis. Results will include maps, statistics, and summary PowerPoint slides for input data to be used in other tasks.

Task 2 – Reservoir Characterization: The EERC will collaborate with Cobra to create a field-scale geologic model for the Wayne Field. This will include petrophysical evaluations and stratigraphic correlation leveraging existing core data and geophysical well logs. Petrophysical interpretations and core analyses will be used to populate the geologic model with applicable properties (e.g., lithofacies, porosity, permeability, and water and oil saturations). Petrophysical property uncertainty analyses will be conducted to create a suite of geologic models. Results will include maps, well interpretations, summaries of created models and uncertainty analysis, and a knowledge gap assessment with data collection recommendations.

Task 3 – Production Analysis: The EERC will coordinate with Cobra to evaluate historic production from the Wayne Field. EERC-proposed activities will include a review of the reservoir characterization tasks with results from the decline curve analysis (DCA) and production key performance indicators (KPI) of the historic production data. Results from this task will include an evaluation of well production and performance, DCA results, and tables of KPI results with summaries in PowerPoint slides.

Task 4 – Data Collection and Field Testing: To facilitate Tasks 2 and 3, additional data collection is required to fill knowledge gaps. Activities for this task will be discussed and designed based on Cobra’s planned operations. Activities for this task could include:

- Downhole pressure data to characterize oil behavior.
- Petrophysical and borehole image logging data for the lateral section.
- Sampling for fluid testing and backside fluid levels.

Task 5 – Installation and Testing of Downhole Equipment: Cobra will install a production liner equipped with multiple stages of mechanically actuating production sleeves within a Wayne Field horizontal well. Using openhole rock packers, the production sleeves will be isolated into segments. Field tests will be conducted by adjusting take points along the lateral sections through recurrent phases of open-and-shut for the installed sleeves over time while monitoring the fluids and pressures. Testing will identify if stranded oil is being accessed and any mitigation of water coning behavior.

Anticipated Results: The anticipated results of this project will be a pilot-scale installation and testing of a production liner equipped with multiple mechanically actuating production sleeves isolated with stages of openhole packers within a horizontal well to produce stranded reserves. Along with the field testing, characterization and production analysis of the Mission Canyon Formation within the Wayne Field will be completed to identify production drivers and reservoir conditions to identify other potential horizontal candidates. Results will be instructive for additional field development and will be prepared for later numerical simulation after enough production histories have been collected. Although the work will focus on the project field operated by Cobra, the learnings from this project will establish baseline operational

strategies for oil production from the resource-rich Mission Canyon throughout the Williston Basin.

Identification of strategies to produce economic volumes of oil from North Dakota's vast Mission Canyon carbonate play will have significant economic and social benefit to the state, municipalities, citizens, and industry.

Facilities and Resources: This project is highly enabled by the operational knowledge and existing field facilities provided by Cobra. Cobra brings operated wells, tank batteries, gathering systems, previously recorded data and results, well records, and technical project field knowledge to the proposed research project. Within the project field, Cobra operates 11 producing wells (four vertical and seven horizontal) and one water injection/disposal well. All producing wells Cobra operates in the project field are completed in the referenced Mission Canyon subinterval. At the time of this application, Cobra does not propose to drill any new wells within the project field. With respect to institutional knowledge and production expertise, Cobra offers over 100 years of total engineering experience and over 50 years of geological experience from its North Dakota technical team. Among technical team capabilities are advanced petrophysics, reservoir engineering, operations engineering, drilling engineering, advanced geophysics, and 9 years of detailed team research of the Mission Canyon Formation. Cobra also offers robust field supervision with over 100 years of experience in direct oversight of the project field. Cobra field employee experience includes North Dakota operations, facilities construction, digital analytics, completions supervision, downhole fishing, and lease operations. In addition to employee expertise, Cobra offers use of software subscriptions for DrillingInfo, PRAMS, PHDWin, Petra, and Kingdom for the research project. In field equipment, Cobra can provide well-testing operations, remote production monitoring, and Echometer equipment for dynamometers and fluid levels.

Project partner EERC employs a multidisciplinary staff of about 270 employees and has 254,000 square feet of state-of-the-art offices, laboratories, and technology demonstration facilities. EERC engineering and scientific research staff members are equipped with state-of-the-art analytical, modeling, and engineering facilities. The EERC has extensive geologic modeling and reservoir simulation capabilities, including multiple high-end workstation computers and a dedicated high-performance

parallel computing cluster. The project team has access to commercial-grade software for use in geologic modeling and process modeling and numerical simulation and database capabilities for managing data that will be collected and generated during the project. The EERC has designed and implemented field activities that include the drilling of stratigraphic test wells, collection of core samples, industry-standard and advanced downhole geophysical logging, downhole pressure and temperature monitoring and collaboration with multiple industry partners on the implementation of field pilots to evaluate EOR techniques in the Bakken Play. EERC laboratory facilities may be utilized through this effort for routine and advanced core analysis, including petrophysical, petrographic, geochemical, and geomechanical rock analysis.

Techniques to Be Used, Their Availability, and Capability: Core-based lithofacies and fracture studies will be conducted on slabbed existing core housed at the Wilson M. Laird Core and Sample Library in Grand Forks, North Dakota. Selected core-based analytical activities will be conducted at the EERC, as necessary, using currently available optical microscopes, porosity testing equipment, and relative permeability testing equipment. Geologic modeling activities will be conducted using industry standard software at the EERC.

Field efforts will take place at a Cobra-operated acreage in Wayne Field within Bottineau County, North Dakota. Cobra has successfully increased oil production, reservoir deliverability, and oil cut up to 10% from the horizontal wells since the field last produced in 2020. Cobra routinely acquires acoustic backside fluid levels of each producing well. This fluid level data provides a proxy for reservoir pressure and reservoir deliverability; it is critical to optimizing production from depleted reservoirs due to the water coning behavior.

All horizontal wells at Wayne Field were completed with an intermediate casing string set to the end of the curve and an openhole lateral. The effective first take point of a well with this design is immediately outside of the intermediate casing at the base of the curve at the heel of the well. It should be assumed that when an openhole horizontal well cones at Wayne Field, the cone will exist around the heel of the well but may not extend down the lateral. When a water cone is formed around the heel of a horizontal well,

artificial lift capacity is occupied by coned fluid rendering the lateral section ineffective. A solution to offset a developed water cone at the heel of an openhole horizontal is to run a liner and isolate multiple take points throughout the lateral. To protect natural permeability, liner application for lateral wells at Wayne Field should be fixed in place with segments of openhole rock packers and not cemented in place. The openhole packers will give near-wellbore isolation and allow segments of the toe portion of the well to also be drained. Liner for the lateral wells at Wayne Field will be unperforated and equipped with multiple stages of mechanically actuating sleeves. These sleeves will be repeatedly opened and closed over time, adjusting the production take point. When a cone develops at a specific take point, that sleeve can be closed to allow the cone time to relax and decrease water production.

Environmental and Economic Impacts While Project Is Underway: No significant environmental or economic impacts are anticipated above and beyond normal operations of oil and gas wells because of these proposed activities. Cobra has upgraded remote monitoring equipment on facilities for production fluid levels and emergency shut-offs.

Ultimate Technological and Economic Impacts: This project will seek to exploit existing oil play infrastructure in the western part of the state to revitalize the Mission Canyon Play. There are more than 600 lateral Madison wells that may benefit from isolated production along the lateral to maximize well productivity. Over 15,000 Bakken wells also penetrate through the Madison Group, which create opportunities to repurpose obsolete or underutilized Bakken well infrastructure to possibly support Mission Canyon production. Potential benefits and impacts of the proposed technology are recognized by members of the oil and gas industry, as noted in the letters of support provided in Appendix A.

Why the Project Is Needed: Maximizing productivity of the Madison system and prolonging productive life of the play ensures the continued long-term economic growth from a proven prolific oil reservoir in North Dakota. Optimizing operational and EOR strategies for legacy fields of the Madison system allows for bypassed pay zones to be accessed and produced. The high water cut of the Madison system requires an innovative alternative approach for recovery, and the proposed research activities are necessary to

expand the critical knowledge base regarding production and EOR strategies to maximize oil production from the formation. The results of the project will provide industry and the state of North Dakota with a foundation for developing a pathway to improve Mission Canyon oil recovery efficiently and economically. Previous tests by Cobra have proven the viability of certain production strategies to improve Mission Canyon oil recovery. The results of this project will significantly expand and demonstrate the current understanding of completion and production optimization strategies that can be applied to Madison Fields throughout North Dakota. Additionally, recompleting wells within the Madison may be a way to extend the life of existing Bakken infrastructure previously deemed unprofitable.

STANDARDS OF SUCCESS

Success will be measured according to the timely achievement of project milestones and development of deliverables that meet the goal of the project. The value to North Dakota is improved understanding of the Mission Canyon Formation with respect to future well operations and potentially improved oil production from the Mission Canyon Formation. Results may directly influence industry practices and lead to improved oil recovery that could increase job opportunities and increase income revenue for North Dakota and its citizens.

BACKGROUND/QUALIFICATIONS

Summary of Prior Work: In January 2024, Cobra leased, bonded, and assumed operations of 11 orphaned wells (seven horizontal and four vertical) from the State of North Dakota at Wayne Field, in Bottineau County, North Dakota. Cobra recognized the potential of the Wayne subinterval of the Mission Canyon Formation. After Cobra's first 10 months of production at Wayne Field, oil production is up 20% and oil cut is up 10% since the field last produced in 2020. Some individual wells are produced with equivalent oil cuts as they had in 2020, but with 300% increases to oil production. Since January 2024, Cobra routinely acquires acoustic backside fluid levels of each producing well. This fluid level data gives a pulse for reservoir pressure and reservoir deliverability and is critical to optimizing production from a reservoir undergoing water coning with a strong underlying water drive.

Experience and Qualifications: Cobra is a privately held independent oil and gas company based in Wichita Falls, Texas, and has been in business for approximately 50 years. Cobra has a legacy of using cutting-edge geologic, geophysical, and engineering technologies for exploration discoveries and operational advancements. Cobra has operated wells in 14 different states and internationally since the company was formed. In 2015, Cobra entered the Williston Basin as a North Dakota Mission Canyon Formation operator of a legacy waterflood. Cobra began extensive research regarding the reservoir characteristics of the Madison Group's Mission Canyon Formation, with emphasis on the hydrodynamic effects of the tilted accumulations in the Billings County area. With proven success in the Mission Canyon Formation, Cobra expanded its asset position in 2018 and now operates in ten different counties of North Dakota. Cobra operates wells that produce exclusively from 12 different conventional formations of the Williston Basin. Cobra's Williston Basin focus for enhancing well productivity revolves around petrophysical and geological evaluation of pipe pay of conventional formations and stressing of fundamental operating techniques. Cobra employs a technical staff of three full-time geologists and five full-time engineers.

The EERC is a high-tech, nonprofit branch of UND, exclusively conducting applied research for a multinational client base. Through 70+ years of collaborating with industry and government on hydrogen technology development, the EERC is globally recognized for its role in advancing commercial deployment of technologies for producing, purifying, and utilizing hydrogen from coal, natural gas, and renewables. The EERC-housed research initiatives focus on techno-economic studies, technology development, and pilot- and demonstration-scale testing.

Personnel: Mr. Kyle Gardner, Cobra Vice President of Engineering, will serve as Project Manager and lead Cobra activities. Mr. Gardner will be supported by Mr. Josh Aaron and Mr. Bud Dillard, Cobra Geologists. Mr. Matthew Belobraydic, EERC Assistant Director for Geosciences, will oversee the entire project. Mr. Belobraydic will have project support from Dr. Kyoung Min, EERC Senior Reservoir Engineer; Dr. Fazilatun N. Mahmood, EERC Geochemist; and Mr. Jamie Schod, EERC Research

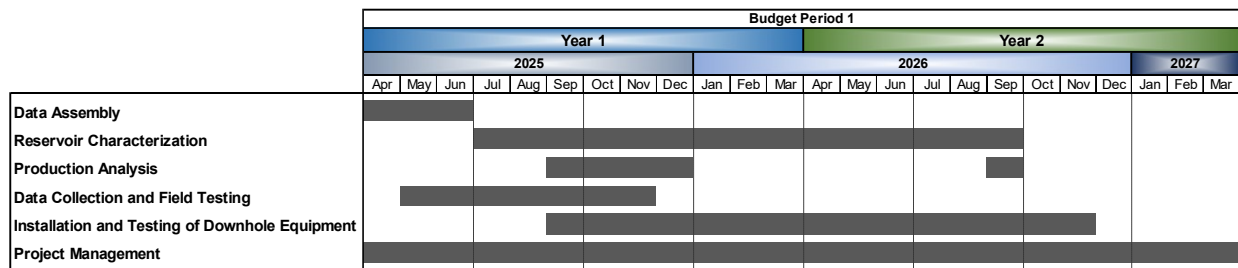
Manager. Project advisors from the EERC include John Harju, EERC Vice President for Strategic Partnerships and Bethany Kurz, EERC Director of Subsurface Characterization and Community Engagement. Resumes of key personnel are included in Appendix B.

MANAGEMENT

Overall management and reporting of the project will be handled by subcontractor EERC in close partnership with Cobra. Mr. Gardner will lead Cobra activities. Mr. Belobraydic will oversee the entire project. Mr. Belobraydic will be assisted in management of project activities by the EERC leadership team. The EERC manages over 200 contracts a year, with a total of more than 1300 clients in 53 countries. Systems are in place to ensure that projects are managed within budget, schedule, and scope. Mr. Belobraydic will be responsible for project coordination, guidance, and supervision to ensure consistent progress and adherence to budget and schedule constraints. Status reports will be submitted to the North Dakota Industrial Commission (NDIC) within 30 days after the end of each status period to provide timely highlights of ongoing research activities. A final report will be provided to legislative management, NDIC, and the Oil and Gas Research Council summarizing the results of the study.

TIMETABLE

The proposed project duration is estimated at 24 months. The timeline in Figure 1 shows the anticipated timing and duration of each task. The timeline will be adjusted if Cobra receives the proposed funding from OGRP past the anticipated start date.



10/28/24 JAS

Figure 1. Project timeline.

BUDGET

The total estimated cost for the proposed scope of work is \$2,000,000. The request from OGRP is \$1,000,000. Cobra will provide \$1,000,000 in cash cost share toward the project. The budget provided in the table was developed based on estimates to perform the proposed scope of work and experience with similar projects.

Project-Associated Expense	NDIC Share	Cobra Share (cash)	Total Project
Labor – Engineering and Field	\$87,500	\$87,500	\$175,000
Facilities, Equipment, Gathering	\$62,500	\$62,500	\$125,000
Stimulation	\$175,000	\$175,000	\$350,000
Field Services – Rigs, Wireline, Testing, Coil	\$125,000	\$125,000	\$250,000
Downhole Production Equipment	\$200,000	\$200,000	\$400,000
Subcontractor – EERC	\$350,000	\$350,000	\$700,000
Total Project Cost	\$1,000,000	\$1,000,000	\$2,000,000

AFFIDAVIT OF TAX LIABILITY

Cobra has no outstanding tax liability to the State of North Dakota nor any of its political subdivisions.

CONFIDENTIAL INFORMATION

There is no confidential information included in this proposal.

PATENTS/RIGHTS TO TECHNICAL DATA

No patentable technologies are expected to be created during this work.

STATUS OF ONGOING PROJECTS

Cobra has Contract G-058-144 “Maximizing Production from Residual Oil Zones in Western North Dakota” current in progress funded through NDIC OGRP. The project is in good standing and current with all reporting, within scope and budget, and is projected to be delivered on time.

APPENDIX A
LETTERS OF SUPPORT



October 28, 2024

Mr. Kyle Gardner
Vice President – Engineering
Cobra Oil & Gas Corporation
PO Box 8206
Wichita Falls, TX 76307

Dear Mr. Gardner:

Subject: EERC Proposal No. 2025-0050 Entitled “Reservoir Characterization and Production Analysis of the Wayne Field, North Dakota”

The Energy & Environmental Research Center (EERC) is pleased to provide the attached proposal outlining the scope of work (SOW) and associated cost to characterize the Wayne Field reservoir and investigate methods and strategies to maximize recovery from the horizontal wells within Wayne Field, North Dakota.

The estimated project cost is \$700,000. Expenses will be invoiced monthly on a cost-reimbursable basis. Initiation of the proposed work is contingent upon the execution of a mutually negotiated agreement between our organizations.

If you have any questions concerning this proposal, please feel free to contact me by phone at (701) 777-5030 or by email at mbelobraydic@undeerc.org.

Sincerely,

DocuSigned by:

Matt Belobraydic

775DACB519E64A8...

Matthew L. Belobraydic

Assistant Director for Geosciences

MLB/bjr

Attachment

October 30, 2024



Mr. Kyle Gardner
Vice President Engineering
Cobra Oil & Gas Corporation
PO Box 8206
Wichita Falls, TX 76307

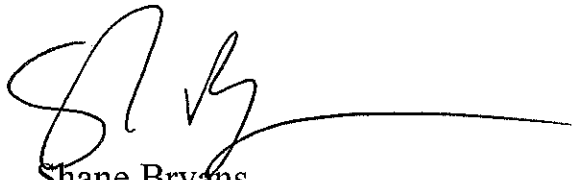
Dear Mr. Gardner:

I am pleased to provide my support for Cobra Oil & Gas Corporation's (Cobra's) proposed project entitled, "Maximizing Lateral Well Oil Production from Conventional Carbonate Mission Canyon Reservoirs in North Dakota." As a member of the North Dakota Petroleum Council Board and Vice President of Ham's Well Service, I am excited about the technology that Cobra is proposing to implement and the benefit that this approach could bring to North Dakota's conventional oil reservoirs.

Technologies and production strategies to revitalize and/or extend the lifetime of our conventional oil fields, such as the Mission Canyon reservoir and other carbonate reservoirs within the prolific Madison system, are needed to support oil and gas production in the state, sustain North Dakota's oil and gas industry and provide ongoing economic opportunities for North Dakota's residents and communities. The technology being proposed by Cobra would provide a mechanism to isolate and control production from different zones along the length of lateral wellbores, thereby creating access to pay zones that had previously been bypassed.

Given that there are more than 600 lateral wells in the Madison system, the successful completion of the proposed pilot project will provide the oil and gas industry and the state of North Dakota with a strategy to significantly improve Mission Canyon oil recovery efficiently and economically. I support this proposed effort and look forward to the results and information derived from the project, if awarded.

Sincerely,

A handwritten signature in black ink, appearing to read 'S. Bryans', with a long horizontal line extending to the right.

Shane Bryans
Vice President
Ham's Well Service Inc.
Westhope, ND 58793

APPENDIX B

RESUMES

KYLE GARDNER

Vice President – Engineering, Owner

Cobra Oil & Gas Corporation

2201 Kell Blvd, Wichita Falls, TX, 76308

Phone: 940-716-5100 Email: kgardner@cobraogc.com

Professional Summary

Mr. Kyle Gardner has over 14 years of experience as a petroleum engineer with privately held oil and gas companies. He currently manages Cobra Oil & Gas Corporation's operations, production, and engineering team. He is also leader of Cobra's technical reservoir and petrophysical team. Mr. Gardner has a background in drilling engineering and a forte in carbonate petrophysical formation evaluation. He has a B.S. degree in Petroleum Engineering from Texas Tech University in Lubbock, Texas.

- 14 years of operational experience of managing daily production, drilling activities, and completion efforts.
- Has planned, executed, and managed the vertical and horizontal drilling and completions of wells Cobra has operated in nine different states of depths from 4,000' TVD to 18,000' TVD, most of which were wildcats of conventional and unconventional targets.
- Leads petrophysical formation evaluator with emphasis in bypassed conventional pay zones of carbonates.
- Experienced in residual oil zone research and field application in the Permian and Williston Basins.
- Evaluates Cobra acquisitions and divestitures, creates operational budgeting, manages company operating expenses.
- Experienced in economic evaluation software, Echometer equipment and software, and remote production management software.

- Board Member of the North Dakota Petroleum Council
- Board Member of the Texas Alliance of Energy Producers
- Member of SPE, AADE, and AAPG.

Bud Dillard

Geologist

Cobra Oil & Gas Corporation

2201 Kell Blvd, Wichita Falls, TX, 76308

Phone: 682-429.5285; Email: bud@cobraogc.com

Education and Training

Robert L. Bolin Graduate School of Geology—Fall 2016 – May 2020

Midwestern State University, Wichita Falls, Texas

- M.S. Geology with Petroleum Geology Emphasis—GPA: 4.0
- Thesis Topic: Lower Spraberry, Jo-Mill Sandstone, Permian Basin -- Borden, Dawson, Howard and Martin Counties, West Texas

University of Texas at Arlington, Texas—Graduated in December 2014

- B.S. in Geology; Minor in Biology

Texas Christian University, Fort Worth, Texas—Fall 2008 – Fall 2011

Research and Professional Experience

Cobra Oil & Gas Corporation, Wichita Falls, Texas—May 2020 – Present

Williston Basin Geologist

- Working legacy fields with existing conventional PDP, stacked reservoirs on the Northern Madison Shelf, in addition to the Nesson and Billings Anticline areas.
- Provides subsurface interpretation and project management as well as conducts local and regional field studies to evaluate potential behind-pipe pay zones.

Cobra Oil & Gas Corporation, Wichita Falls, Texas—May 2017 – May 2020

Entry Level Geologist; Geo-Technician

- Proficient in IHS Petra software; some experience with IHS Kingdom and GeoGraphix software.
- Worked NW Shelf Delaware Basin, Permian San Andres D in Lea and Eddy Counties, New Mexico; Hardeman Basin, Mississippian Chappel Limestone in Hardeman County, Texas.

Stivers Consulting, Inc., Graham, Texas—January 2015 – May 2016

Mud Logger

- Analyzed/described rock lithology via microscopy, evaluated hydrocarbon shows, monitored drilling activity, prepared mud log.

University of Texas at Arlington, Arlington, Texas—August – November 2014

Student Research

- Assisted PhD student with processing rock samples for dissertation work: Reconstructing Paleogene paleoclimate and paleoenvironment for terrestrial rock of the Green River Basin, SW Wyoming, using carbon isotope ratio in sediments.

Professional Activities

Society of Sigma Gamma Epsilon, Texas Epsilon Zeta Chapter—Fall 2017 – Spring 2020

- National Honor Society for the Earth Sciences

American Association of Petroleum Geologists Student Chapter—Fall 2016 – Fall 2018

- Chapter President – Spring 2018 – Fall 2018
- Chapter Senator, Student Government Association – Fall 2016 – Fall 2017

North Texas Geological Society—Fall 2016 – Present

Fort Worth Geological Society—Fall 2022 – Present

JOSH AARON

6725 Kit Carson Trl, Wichita Falls, TX 76310 · 940-631-0408

jaaron@cobraogc.com

EXPERIENCE

JANUARY 2020 – PRESENT

WILLISTON BASIN PETROLEUM GEOLOGIST, cobra oil and gas co.

- *Provide subsurface interpretation and project management for oil and gas exploration in the conventional reservoirs (Ordovician-Mississippian, & Permian-Triassic Fms.) of the Williston Basin. Conduct local and regional field studies to determine extent and volumetric estimates of conventional oil & gas reservoirs and prioritize existing PDNP behind-pipe zones with greatest potential.*
- *Assisted on other projects including the Hardeman Basin (Mississippian Chappel Limestone), Uintah Basin (Entrada Sands), and Clay County, TX (Strawn Formation).*

JANUARY 2019 – JANUARY 2020

GEO TECHNICIAN/ ENTRY LEVEL GEOLOGIST, lmh energy

- *Performed all mud logging and actively participated in well logging and completions on exploration, and development wells. Constructed well log correlation and subsurface mapping on conventional prospects in KMA and Archer County fields, North Texas.*

MAY 2017 – AUGUST 2018

PRODUCTION OPERATOR, msb operating

- *Sustain production, maintain rig equipment, operate work-over rig, service flow and injection lines.*

EDUCATION

AUGUST 2017- DECEMBER 2019

MASTER OF SCIENCE IN PEROLEUM GEOLOGY, midwestern state university

The Robert L. Bolin Graduate School of Petroleum Geology

GPA: 4.0

- **THESIS:** Subsurface Isopach Mapping of the Major Depositional Sequences of the Ordovician Bromide Formation, South Central Oklahoma (Advisor: Jesse Carlucci, Ph. D.)
- **LABORATORY/GRADUATE TEACHING ASSISTANT-** *Lead multiple geology laboratory courses as an independent instructor. Developed management and oversight skills while directing these courses.*

AUGUST 2013- MAY 2017

BACHELOR OF SCIENCE IN GEOSCIENCES, midwestern state university

- **UNDERGRADUATE STUDENT RESEARCH-** *Preformed facies examination through X-ray powder diffractometry (Rigaku Miniflex) on the Pontotoc Sandstone Submember of the Bromide Formation, Oklahoma.*



MATTHEW L. BELOBRAYDIC

Assistant Director for Geoscience

Energy & Environmental Research Center (EERC), University of North Dakota (UND)

15 North 23rd Street, Stop 9018, Grand Forks, North Dakota 58202-9018 USA

701.777.5030, mbelobraydic@undeerc.org

Principal Areas of Expertise

Mr. Belobraydic’s principal areas of interest and expertise include stratigraphic and structural interpretations, geologic characterization, data science, process automation, geostatistical analysis, geomodeling, and uncertainty analysis.

Education and Training

M.S., Geology, Ball State University, 2006. Thesis: “Drainage Basin Analysis and Fluvial Geomorphic Reconstruction Plan for the Killbuck–Mud Creek Subwatershed, Delaware County, Indiana.”

B.S., Geology, University of Idaho, 2003. Senior Project: “Drainage Analysis for Colfax South, Diamond, Dusty, Thera, Thornton Quadrangles and an Experimental Quadrangle of Eastern Washington.”

Research and Professional Experience

September 2022–Present: Assistant Director for Geoscience, EERC, UND. Mr. Belobraydic collaborates with EERC subject matter experts, principal investigators, and leadership to prepare proposals and pursue new business opportunities and leads and manages projects in the areas of enhanced oil recovery (EOR) in conventional and unconventional formations, CO₂ and produced

gas storage, natural resource management, critical materials resource characterization and recovery, geologic and synthetic materials characterization, produced water management, and the environmental aspects of energy development.

- Manages a team of petrophysicists and subsurface data management professionals.
- Coaches and mentors more than ten geoscientists in geology, stratigraphy, geostatistical, geologic modeling, and uncertainty methods.
- Develops strategic plans for petrophysical products and data-handling procedures for subsurface teams.
- Assists the Director of Analytical Solutions by providing business directions for technical reports and technical expertise.
- Creates project proposals and maintains client relationships.

December 2020–September 2022: Principal Geoscientist, Geoscience and Engineering Group, EERC, UND. Mr. Belobraydic collaborated with EERC subject matter experts and principal investigators to create geological interpretations and prepared proposals in the areas of EOR in conventional and unconventional formations, CO₂ and produced gas storage, natural resource management, geologic materials characterization, produced water management, and environmental aspects of energy development.

- Mentored geoscientists as subject matter expert in geology and geological modeling for more than ten federal, state, and private contracts.
- Coached modeling team members through team-building and workflow improvement exercises.
- Characterized reservoirs and depositional environments for projects to maximize subsurface understanding and minimize development risk.

- Managed resources, budgets, and timelines on projects to successfully complete within deadlines and scope.

October 2020 – December 2020: Geoscientist, EERC, UND. Mr. Belobraydic produced geology and geological modeling results for CO₂ storage projects as part of an integrated team of EERC subject matter experts. Specific activities included the following:

- Produced 3D geologic models for CO₂ storage for select clastic formation within the Williston Basin.
- Coached three geoscientists through geostatistical and geomodeling methods as on-the-job training.

September 2008–April 2020: Senior III Reservoir Geologist, Schlumberger, Denver, Colorado. Mr. Belobraydic produced data-driven client solutions as part of a multidisciplinary consulting team, improving internal technical processes and workflows to increase efficiency and maximize profits. Specific activities included the following:

- Managed team of petrophysicist, geophysicist, geologist, and reservoir engineers from proposal to project close as technical lead for more than ten client projects.
- Introduced Agile and Scrum project management to local consulting team, changing work processes, shortening turnaround times by 66% and increasing bottom line.
- Reviewed green energy workflows and processes for internal geothermal and carbon capture and storage teams as subject matter expert to mitigate risk and uncertainty.
- Initialized and maintained backlog for basin interpretation cloud subscription service as Scrum product owner to capture previously inaccessible market share.
- Adapted working style and deliverables to become trusted technical advisor for more than 20 client organizations, each with unique business priorities.

- Coordinated stakeholders and potential clients for four cloud subscription service offerings to maximize value, drive communication, and quantify feedback of results.
- Created harmonious and integrated team environments for technical staff from both Schlumberger and client organizations for project collaborations.
- Characterized petroleum systems and depositional environments for client acreage to maximize reservoir understanding and minimize development risk.
- Interpreted structure and stratigraphy for full 3D models, combining seismic data for conventional and unconventional plays in more than ten basins and 30 fields globally.
- Analyzed raw and interpreted data to generate geostatistically accurate static reservoir models in Petrel on more than five projects per year for worldwide clients.
- Published and automated uncertainty optimization technique, reducing dynamic simulation iterations by 80% and generating a positive feedback loop to initial inputs.
- Built custom Python, SQL, and Petrel workflows, increasing productivity by up to 900%.
- Coached and mentored more than 30 individuals through organized team-building activities and formal career development.
- Created advanced modeling curriculum and training programs in Petrel for more than 25 junior geoscientists.
- Published results and methodologies for select client work as posters and papers to technical conferences and professional societies.
- Requested presenter to professional societies for geology, data science, and machine learning.
- Prepared and reviewed proposals, reports, and project documentation, effectively communicating technical results and methodology to clients and working teams.

September 2006–August 2008: CO₂ Enhanced Oil Recovery Research Assistant, UND. Mr.

Belobraydic researched CO₂ EOR and sequestration potential for the Williston Basin alongside the EERC. Specific activities included the following:

- Generated systematic approach for assessing EOR and carbon dioxide sequestration for fields of interest.
- Produced 3D reservoir models to simulate EOR and carbon dioxide sequestration potential.

May 2005–May 2006: National Science Foundation GK–12 Fellow, Ball State University,

Muncie, Indiana. Mr. Belobraydic provided in-classroom support to Indianapolis Public Schools (IPS) teachers through inquiry-based lessons and assisted in professional development for K–8 science standards. Specific activities included the following:

- Developed middle school Earth science curriculum and lessons for IPS.
- Provided aid in the professional development of IPS teachers as a knowledge resource.

Professional Activities

Member, American Association of Petroleum Geologists

Member, Rocky Mountain Association of Geologists

Publications

Mr. Belobraydic has authored or coauthored numerous professional publications.



DR. JOHN A. HARJU

Vice President for Strategic Partnerships

Energy & Environmental Research Center (EERC), University of North Dakota (UND)

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Principal Areas of Expertise

Dr. Harju's principal areas of interest and expertise include carbon sequestration, enhanced oil recovery, unconventional oil and gas development, waste management, geochemistry, technology development, hydrology, and analytical chemistry, especially as applied to the upstream oil and gas industry.

Education and Training

Ph.D., Petroleum Engineering, University of North Dakota, 2022.

M.Eng., Petroleum Engineering, University of North Dakota, 2020.

B.S., Geology, University of North Dakota, 1986.

Research and Professional Experience

2002–Present: EERC, UND.

July 2015–Present: Vice President for Strategic Partnerships. Dr. Harju leads efforts to build and grow dynamic working relationships with industry, government, and research entities globally in support of the EERC's mission to provide practical, pioneering solutions to the world's energy and environmental challenges. He represents the EERC regionally, nationally,

and internationally in advancing its core research priorities: coal utilization and emissions, carbon management, oil and gas, alternative fuels and renewable energy, and energy–water.

2003–June 2015: Associate Director for Research. Dr. Harju led a team of scientists and engineers building industry–government–academic partnerships to carry out research, development, demonstration, and commercialization of energy and environmental technologies.

2002–2003: Senior Research Advisor. Dr. Harju developed, marketed, managed, and disseminated research programs focused on the environmental and health effects of power and natural resource production, contaminant cleanup, water management, and analytical techniques.

2017–Present: Adjunct Lecturer, Department of Petroleum Engineering, UND.

1999–2002: Vice President, Crystal Solutions, LLC, Laramie, WY. Dr. Harju’s firm was involved in commercial E&P produced water management, regulatory permitting and compliance, and environmental impact monitoring and analysis.

1997–2002: Gas Research Institute (GRI) (now Gas Technology Institute [GTI]), Chicago, IL.

2000–2002: Principal Scientist, Produced Water Management. Dr. Harju developed and deployed produced water management technologies and methodologies for cost-effective and environmentally responsible management of oil and gas produced water.

1998–2000: Program Team Leader, Soil, Water, and Waste. Dr. Harju managed projects and programs related to the development of environmental technologies and informational products related to the North American oil and gas industry; formulated RFPs, reviewed proposals, and formulated contracts; performed technology transfer activities; and supervised staff and contractors. He served as Manager of the Environmentally Acceptable Endpoints project, a multiyear program focused on rigorous determination of appropriate cleanup levels for

hydrocarbons and other energy-derived contaminants in soils. He led GRI/GTI involvement with industry environmental consortia and organizations, such as PERF, SPE, AGA, IPEC, and API.

1997–1998: Principal Technology Manager (1997–1998) and Associate Technology Manager (1997), Soil and Water Quality.

1988–1996: EERC, UND.

1994–1996: Senior Research Manager, Oil and Gas Group. Dr. Harju served as:

- Program Manager for assessment of the environmental transport and fate of oil- and gas-derived contaminants, focused on mercury and sweetening and dehydration processes.
- Project Manager for field demonstration of innovative produced water treatment technology using freeze crystallization and evaporation at oil and gas industry site.
- Program Manager for environmental transport and fate assessment of MEA and its degradation compounds at Canadian sour gas-processing site.
- Program Manager for demonstration of unique design for oil and gas surface impoundments.
- Director of the National Mine Land Reclamation Center for the Western Region.
- Co-PI on project exploring feasibility of underground coal gasification in southern Thailand.
- Consultant to an International Atomic Energy Agency program entitled “Solid Wastes and Disposal Methods Associated with Electricity Generation Fuel Chains.”

1988–1994: Research Manager (1994), Hydrogeologist (1990–1994), Research Specialist (1989–1990), and Laboratory Technician (1988–1989).

Professional Activities

Member, National Coal Council (appointed 2018)

Member, National Petroleum Council (appointed 2010)

Member, Mainstream Investors, LLC, Board of Governors (2014–present)

Member, DOE Unconventional Resources Technology Advisory Committee (2012–2014)

Member, Interstate Oil and Gas Compact Commission (appointed 2010)

Member, Rocky Mountain Association of Geologists

Publications

Dr. Harju has authored or coauthored more than 100 professional publications and nearly 300 technical presentations.



BETHANY A. KURZ

Director of Analytical Solutions

Energy & Environmental Research Center (EERC), University of North Dakota (UND)

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Principal Areas of Expertise

Ms. Kurz's principal areas of interest and technical expertise include carbon capture, utilization, and storage (CCUS); produced natural gas storage; enhanced oil recovery (EOR) in conventional and unconventional oil and gas reservoirs; application of machine learning and data analytics to CCUS and oil and gas development; produced water and drilling waste management; assessment of critical materials in coal and produced brine; and resource management related to energy development.

Education and Training

M.S., Hydrogeology, University of North Dakota, Grand Forks, ND, 1998.

B.S., Geochemistry, Bridgewater State University, Bridgewater, MA, 1995.

Research and Professional Experience

May 2021–Present: Director of Analytical Solutions, EERC, UND. Ms. Kurz is responsible for developing business and research opportunities to address challenges in all areas of energy and natural resources development and management. She leads programs and projects related to CCUS; application of machine learning and artificial intelligence to CCUS and conventional and unconventional oil and gas development; EOR; produced water and drilling waste management; and critical materials resource assessments. Ms. Kurz also leads the EERC's research laboratories and a multidisciplinary team of scientists and engineers focused on addressing the

needs of our partners and clients in areas related to energy development and management and environmental stewardship.

July 2018–April 2021: Assistant Director of Integrated Analytical Solutions, EERC, UND. Ms. Kurz was responsible for assisting the EERC’s leadership team with developing business opportunities and successfully executing research projects related to oil and gas; natural resource management; and CCUS. She oversaw a multidisciplinary team of scientists and engineers who work in the EERC’s applied research laboratories. In that role, she was responsible for ensuring the quality assurance/quality control of data and results generated by the EERC’s laboratories and integrating those results into the applied research efforts conducted by the Subsurface R&D team.

2011–July 2018: Principal Hydrogeologist, Laboratory Analysis Group Lead, EERC, UND. Ms. Kurz oversaw a multidisciplinary team of scientists and engineers and several of the EERC’s analytical research laboratories that focus on classical and advanced wet-chemistry analyses; petrochemical, geochemical and geomechanical evaluation of rocks and soils; and advanced characterization of various materials, including metals, alloys, catalysts, and corrosion and scale products. Her primary areas of interest included the evaluation of water supply sources for the oil and gas industry, produced water management, characterization of geologic media for carbon storage and development and testing of proppants for use in hydraulic fracturing.

2002–2011: Senior Research Manager, Water Management and Flood Mitigation Strategies, EERC, UND. Ms. Kurz’s responsibilities included project management, technical report and proposal writing, public outreach, and the development of new research focus areas. Research activities included the evaluation of nontraditional water supply sources for municipal and

industrial use, flood and drought mitigation, watershed-scale water quality assessments using hydrologic models, and public education and outreach on various water and energy issues.

1998–2002: Research Scientist, Subsurface Remediation Research, EERC, UND. Ms. Kurz’s responsibilities included managing and conducting research involving remediation technologies for contaminated groundwater and soils, groundwater sampling and analysis, technical report writing, and proposal research and preparation.

Publications

Ms. Kurz has coauthored numerous professional publications.



FAZILATUN NESSA MAHMOOD

Geochemist

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15 North 23rd Street, Stop 9018, Grand Forks, North Dakota 58202-9018 USA

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Education and Training

Ph.D. Candidate, Geology, University of North Dakota, 2016–Present.

M.S., Geology, University of Saskatchewan, Saskatoon, Saskatchewan, Canada, 2016.

M.S., Hydrogeology, University of Dhaka, Dhaka, Bangladesh, 2005.

B.S., Geology, University of Dhaka, Dhaka, Bangladesh, 2002.

Software proficiency includes Microsoft Office Suite, MATLAB, ArcGIS, Grapher, Surfer (graphing, plotting, and analysis software), and Modflow (groundwater flow-modeling software).

Research and Professional Experience

March 2024–Present: Geochemist, EERC, UND.

- Interfaces with diverse team of scientists and engineers to assess project uncertainties in oil and gas development and geologic storage.
- Develops and oversees development of geophysical and geochemical models of subsurface.
- Performs regional geological characterization and analyses of data.
- Assists in preparation of technical proposals, reports, and presentations.

Work currently involves developing geophysical and geochemical models of the subsurface and performing regional geological characterization and analyses of data, testing, and application of NRAP tools (Open-IAM and DREAM).

November 2020–March 2024: Geoscientist, EERC, UND.

- Interfaced with diverse team of scientists and engineers to assess project uncertainties in oil and gas development and geologic storage.
- Developed and oversaw development of geophysical models of subsurface.
- Performed regional geological characterization and petrophysical analyses of geophysical well log data.
- Assisted in preparation of technical proposals, reports, and presentations.

May 2020–October 2020: Research Assistant (student intern), EERC, UND.

August 2016–Present: Research/Teaching Assistant, UND.

- Used pure strains of chemostat continuous cultured marine diatoms grown at different silicic acid concentrations to investigate effect of silica concentration on diatom's oxygen isotope ($\delta^{18}\text{O}$) composition.
- Studied stable carbon-isotope ($\delta^{13}\text{C}$) profiles of marine carbonate cores taken from the upper Red River Formation of the Williston Basin and its correlation with an isotope record established in the North American Midcontinent (Cincinnati region), Quebec, and Estonia.
- Team-taught 120 freshmen-year students (GEOL 101L, Introduction to Geology Laboratory, and GEOL 102L, The Earth Through Time Laboratory) and 20 graduate-level students (GEOL 540, Water Sampling and Analysis).

September 2012–June 2016: Research Assistant, University of Saskatchewan, Saskatoon, Saskatchewan, Canada.

- Researched origin and fate of nitrate in waste rock dump of coal mine in British Columbia using dual isotopes ($\delta^{15}\text{N}$ & $\delta^{18}\text{O}$) and high-resolution water-soluble and porewater chemistry data.

July 2006–April 2009: Geologist, Chevron International Exploration and Production, Dhaka, Bangladesh, and Chevron Energy Technology Company (ETC), Sugar Land, Texas.

- Worked on Bibiyana Gas Field Development Project including the following activities:
 - Performed operational geology responsibilities.
 - Crosschecked drilling and geological database collected from contractor/vendor and service companies and also guided them according to company demand.
 - Integrated seismic and well data from drilling program to evaluate reservoirs.
 - Performed preliminary formation evaluations for prospect identification using Landmark software (SeisWorks, StratWorks) and mapped planned and prospective horizons.
 - Performed geostatistical modeling using GOCAD (2.1.6).
 - Developed structural framework from seismic interpretation.
 - Performed petrophysical modeling.

July 2005–April 2006: Geologist, Department of Public Health Engineering, Dhaka, Bangladesh.

- Worked on Deep Aquifer Database Development Project Arsenic Policy Support Unit, DFID, and JICA.

Professional Activities

Member, American Association of Petroleum Geologists

Publications

Has coauthored numerous publications.



JAMIE A. SCHOD

Research Manager

Energy & Environmental Research Center (EERC), University of North Dakota (UND)

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Principal Areas of Expertise

Mr. Schod's primary areas of interest and expertise are igneous and metamorphic petrology, remediation, reclamation, stormwater management, and project management.

Education and Training

B.S., Geology, University of North Dakota, 2019. Thesis: "Distribution and Spatial Autocorrelation Analysis of Martian Periglacial Polygon Formations."

Research and Professional Experience

June 2023–Present: Research Manager, EERC, UND. Mr. Schod is responsible for working with principal investigators and project managers to facilitate scientific research; coordinating and writing proposals in response to federal, state, and commercial funding opportunities; monitoring project progress; supporting project management activities; coordinating scopes of work; planning budgets and timelines; and executing research activities.

March 2021–May 2023: Staff Geologist and Project Manager, Terracon Consultants, Inc. Mr. Schod developed business opportunities with commercial, state, and federal entities while managing and leading projects involved with environmental site assessments, limited site investigations, remediation, reclamation, stormwater management, and geotechnical industries.

Professional Activities

Member, North Dakota Geological Society

Member, The Planetary Society



DR. KYOUNG MIN

Reservoir Engineer

Energy & Environmental Research Center (EERC), University of North Dakota (UND)

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Education and Training

Ph.D., Petroleum Engineering, Texas A&M University, 2013.

M.E., Mechanical Engineering, Texas A&M University, 2008.

M.S., Mechanical Engineering, University of Michigan Ann Arbor, 2006.

Programming Skills

Languages: FORTRAN, C++, MATLAB, VBA, OpenMP for parallel computing

- Python libraries: scikit-learn, NumPy, pandas, matplotlib, keras

Programs: CMG, Eclipse, tNavigator, Kappa, Prosper, Petrel RE, GOCAD

- JMP, Spotfire, ABAQUS, HF software (GOHFER, Kinetix, FracPro)

Research and Professional Experience

March 2022–Present: Reservoir Engineer, EERC, UND.

- Pursues problem solving related to advanced challenges in conventional and unconventional reservoirs such as production mechanisms and enhanced oil recovery (EOR) in tight reservoir rocks, CO₂ or produced gas-based storage, and production data analysis and interpretation for unconventional reservoirs.

Principal areas of interest and expertise include data analytics (machine learning [ML]/artificial intelligence [AI]), geomechanics, and reservoir engineering.

July 2020–May 2021: Research Reservoir Engineer, Eden GeoTech, Somerville, Massachusetts.

- Developed reservoir stimulation/monitoring design for low-carbon EOR methods, funded by National Science Foundation (NSF).
- Produced research proposals (U.S. Department of Energy [DOE], NSF) and conducted industry meetings as project leader.
- Developed predictive models using data-driven methods and multiphysics simulation.

February–June 2020: Senior Research Associate, University of Oklahoma.

- Developed hybrid data-physics ML model to predict well interference and completion efficiency.

April–June 2019: Staff Reservoir Engineer, Pioneer Natural Resources.

- Developed integrated geomechanics–reservoir simulation workflow optimization for completion design, well-spacing/stacking, parent–child, well control, and EOR.
- Constructed and calibrated reservoir models for multiwell development in stacked reservoirs.

June 2014–March 2019: Senior Reservoir Engineer–Data Scientist, Anadarko Petroleum Corporation.

- Project leader in Advanced Analytics team to develop completion optimization and reservoir characterization tools using data analytics/ML techniques and physics-based simulation.
- Developed field development tool (EUR, CAPEX, OPEX) using public and internal data sources (RSEG, DrillingInfo, IHS). Identified data trends and key development factors to maximize NPV.
- Developed a coupled geomechanics–reservoir simulation to optimize well spacing, completion design, choke management, and targeting for full-field development plan.
- Developed hybrid data physics method for fast production forecast and uncertainty quantification using statistical methods, Monte-Carlo simulation, and Bayesian approach.

- Led multiteam collaboration to develop data-driven basin evaluation tool for key driver identification, sweet-spot recognition, and development optimization.
- Analyzed production, reservoir fluid, geology, and completion data to construct structured dataset.
- Utilized field data (RTA/PTA, DFIT, BHP) to estimate reservoir properties/performance.

April 2013–May 2014: Reservoir Geomechanics Consultant, Shell Oil Company.

- Assessed development risks by injection/depletion induced dynamics, compaction/subsidence, fault reactivation, and cap rock integrity using full-scale reservoir–geomechanics simulation.
- Multiscale geomechanics modeling for well integrity analysis for depleted deep-water reservoirs.

May–August 2011: Summer Intern, Idaho National Laboratory.

- Geomechanics module development; developed hydraulic fracturing simulation algorithm for enhanced geothermal system using C++ and parallel solver tool kits in HPC environment.

Professional Activities

Reviewer, *Journal of Petroleum Science and Engineering*, *Geomechanics and Geophysics for Geo-Energy and Geo-Resources*, *Rock Mechanics and Rock Engineering*, and *American Rock Mechanics Association*.

Publications

Has authored or coauthored numerous professional publications.

APPENDIX C

REFERENCES

Burton-Kelly, M.E., Dotzenrod, N.W., Feole, I.K., Pekot, L.J., He, J., Butler, S.K., Kurz, M.D., Kurz, B.A., Smith, S.A., and Gorecki, C.D., 2018, Identification of residual oil zones in the Williston and Powder River Basins (Final Report): Report prepared by the Energy & Environmental Research Center for DOE Cooperative Agreement No. DE-FE0024453.

Dotzenrod, N.W., Dalkhaa, C., Pekot, L.J., He, J., Burton-Kelly, M.E., Feole, I.K., Bosshart, N.W., Peck, W.D., Ayash, S.C., and Gorecki, C.D., 2017, Fine-scale modeling and simulation of the Big Stick and T.R. Fields, North Dakota, USA (update): Report prepared by the Energy & Environmental Research Center for DOE Cooperative Agreement No. DE-FE0024453.

Jarvie, D.M., 2022, The History of Madison Group Exploration and Production in the North Dakota Williston Basin with an Update on Madison Group Source Rocks. https://www.researchgate.net/publication/368745926_The_history_of_Madison_Group_exploration_and_production_in_the_North_Dakota_Williston_Basin_with_an_update_on_Madison_Group_source_rocks.
DOI:10.31582/rmag.mg.59.3.201.

Jennings, J.B., and Johnson, R.P., 1996, Wayne Field: A Horizontal Drilling Case Study: Expanded Abstracts Volume: American Association of Petroleum Geologists. Rocky Mountain section meeting, Billings, MT, July 28–31, 1996.

**Industrial Commission
Tax Liability Statement**

Applicant:

Cobra Oil & Gas Corporation
2201 Kell Blvd.
Wichita Falls, TX 76308

Application Title:

Controlling Horizontal Well Oil and Water Production within Wayne Field, North Dakota

Program:

- Lignite Research, Development and Marketing Program
- Renewable Energy Program
- Oil & Gas Research Program
- Clean Sustainable Energy Authority

Certification:

I hereby certify that the applicant listed above does not have any outstanding tax liability owed to the State of North Dakota or any of its political subdivisions.



Signature

Vice President - Engineering

Title

11/1/24

Date