COBRA
OIL & GAS CORPORATION

Mailing Address
P.O. Box 8206
Wichita Falls, Texas 76307-8206
Telephone (940) 716-5100
www.cobraogc.com

June 1, 2023

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 Production from Residual Oil Zones in Western 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 methods and strategies to maximize oil recovery within Madison oil fields in western North Dakota. The project will use new and existing reservoir characterization and laboratory analytical data coupled with static and dynamic computer modeling to design and implement pilot-scale field injection tests that will develop and optimize production strategies for residual oil zones in the Madison Group's Mission Canyon Formation.

Please find attached the $100 application fee. 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,

Kyle Gardner
Vice President – Engineering
Cobra Oil & Gas Corporation

KG/rlo

Attachments

Oil and Gas Research Program

North Dakota

Industrial Commission

COBRA OIL & GAS CORPORATION

Application

Project Title: Maximizing Production from Residual Oil Zones in Western North Dakota

Applicant: Cobra Oil & Gas Corporation

Principal Investigator: Kyle Gardner

Date of Application: June 1, 2023

Amount of Request: $2,000,000

Total Amount of Proposed Project: $4,000,000

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

TABLE OF CONTENTS

ABSTRACT

Objective: Cobra Oil & Gas Corporation (Cobra) is seeking funding for a research project to further investigate methods and strategies to maximize oil recovery within Madison oil fields in western North Dakota. The objective of the project is to use new and existing reservoir characterization and laboratory analytical data coupled with state-of-the-art static and dynamic computer modeling to design and implement pilot-scale field injection tests for developing and optimizing production strategies within residual oil zones (ROZs) of the Madison Group's Mission Canyon Formation. The development and implementation of production strategies for North Dakota's ROZ formations would create jobs, increase oil and gas investments, revitalize North Dakota's legacy fields, and increase state tax revenue.

Expected Results: Expected results include a series of field-tested operational and completion parameters for increasing production in the Mission Canyon ROZs. These parameters can be implemented to increase oil production in depleted or existing plays, enabling production of previously uneconomical oil resources in North Dakota.

Duration: The anticipated project duration is 24 months (September 1, 2023, to August 31, 2025).

Total Project Cost: The total project cost is $4,000,000. Cobra is requesting $2,000,000 from the North Dakota Industrial Commission (NDIC) Oil and Gas Research Program. Cobra is providing $2,000,000.

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 play that has produced nearly 1 billion barrels (Bbbl) of oil from ~6000 wells. Other parts of the Madison Group (i.e., Mission Canyon Formation) have been bypassed historically because of higher water saturations. Total oil-in-place reserves for the formation are estimated up to 500 million barrels (Burton-Kelly and others, 2018). These fields and depleted Mission Canyon Fields exhibit properties and behavior similar to residual oil zones (ROZs) that contain remnants of oil stranded within sections of rock and require unique production strategies and/or enhanced oil recovery (EOR) methods to produce the trapped oil. In recent efforts, considerable volumes of oil have been produced from ROZs through CO_2 injection into or depressurization within ROZs (Harouaka and others, 2014; Melzer and Trentham, 2015).

Since 2018, Cobra Oil & Gas Corporation (Cobra) has been the operator of a Mission Canyon Field (the project field) in Renville County, North Dakota, that has allowed for implementation and evaluation of oil production strategies from reservoir zones with high water saturation. Cobra has successfully increased oil production, reservoir deliverability, and oil cut in 16 wells in the project field's depressurizing and acidized simulation experiment. Since 2018, gross production in the project field is up ~250% because of these efforts. Larger acidized stimulations of the reservoir should provide higher production rates which, in turn, should increase oil production. Additionally, previous studies have demonstrated the potential of EOR as a viable method to significantly increase oil production out of the Mission Canyon Formation throughout North Dakota (Dotzenrod and others, 2017; Burton-Kelly and others, 2018). Burton-Kelly and others (2018) estimated that CO_2 EOR could generate an additional 60–90 million barrels of oil in North Dakota's Mission Canyon Formation.

Objectives: Cobra is seeking to further investigate methods and strategies to maximize oil recovery within Mission Canyon Fields in western North Dakota. Example strategies may include further depressurizing experiments of the ROZ to lower the reservoir pressure within a radius around the wellbore and/or CO_2 injection into the ROZ. To test these 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. The EERC has previous experience evaluating the impact of EOR on ROZs in the Williston Basin (Dotzenrod and others, 2017; Burton-Kelly and others, 2018). The data will be utilized to generate a geologic model and perform numerical dynamic simulation to evaluate production and EOR strategies to maximize production from the Mission Canyon ROZs. Cobra will validate the simulation results by applying select production strategies in the project field. The objective of the project is to use new and existing reservoir characterization and laboratory analytical data coupled with state-of-the-art static and dynamic computer modeling to design and implement pilot-scale field injection tests for developing and optimizing production strategies within ROZs of the Mission Canyon Formation. The goal of the pilot tests is to determine the viability of production and EOR strategies developed through numerical simulation for stimulating oil production in the Mission Canyon Formation.

Methodology: This project will incorporate data gathering and processing, laboratory analysis, modeling/ simulation, and field testing to determine optimized operations and completion strategies for production from the selected Mission Canyon ROZ. The work will be conducted in four tasks leading to the successful completion of the stated project goal. Tasks 1–3 will be led by the EERC, which has demonstrated experience in each of the tasks. The EERC's letter of support is found in Appendix A. Task 4 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 software procurement, data assembly, and data audit tasks to identify data necessary for Tasks 2 and 3 and other data gaps. Activities in this task include a core description workshop for the selected field to determine the need for additional core analyses from 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 targeted ROZ. This will include petrophysical evaluations and stratigraphic correlation leveraging existing core data and geophysical well logs. Petrophysical interpretations will be used to populate the geologic model of the selected field 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 available for numerical simulation history-matching and sensitivity analyses for validation against historic field production. Results will include maps, well interpretations, summaries of created models and uncertainty analysis, and a knowledge gap assessment with data collection recommendations.

Task 3 – Numerical Simulation for Production Optimization

The EERC will coordinate with Cobra to evaluate strategies to optimize production from the potential ROZ for the selected field using numerical simulation. EERC-proposed activities will include the creation of a fluid model based on available pressure, volume, temperature (PVT) data for the reservoir; calibration of the Task 2 geologic models through a history-matching process using historic operational data for the selected field; and conducting predictive simulations designed to improve oil production from the field. Working with Cobra, the EERC will develop a case matrix of strategic scenarios for numerical evaluation. Suggested scenarios include evaluating production changes from recompletion and operational changes and evaluating responses from EOR methods (e.g., carbon dioxide injection). A sensitivity analysis will be conducted to inform plans to optimize potential ROZ development and support field development. Results from this task will include predicted incremental oil production and associated pressure response for the cases investigated and learnings from the sensitivity analysis, including a recommended optimization strategy.

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:

- Well testing and assessment of operational changes to existing wells.
- PVT tests to characterize oil behavior.
- Cased hole well log data collection to determine current reservoir fluid saturations.
- Additional testing of existing cores (e.g., routine core analysis, x-ray fluorescence, x-ray diffraction, scanning electron microscopy, mercury injection capillary pressure).
- Recompletion of a well to validate select forward modeling result scenarios.
- Well acidized stimulation.

Anticipated Results: The anticipated results of this project will be field-validated operational and completion strategies for optimizing oil production from the Mission Canyon Formation. 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 ROZs of the Mission Canyon throughout the Williston Basin. Identification of strategies to produce economic volumes of oil from North Dakota's vast Mission Canyon 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 31 producing wells (28 vertical, three horizontal) and 12 water injection/disposal wells. All 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 8 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, 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, and downhole pressure and temperature monitoring. EERC laboratory facilities will 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 using currently available optical microscopes, porosity testing equipment, and relative permeability testing

equipment. Static and dynamic modeling activities will be conducted using industry standard software on computer hardware currently existing at the EERC.

Field efforts will take place at a Cobra-operated Mission Canyon Field in Renville County, North Dakota. Cobra has successfully increased oil production, reservoir deliverability, and oil cut in 16 wells in the project field's depressurizing experiment. Of the 31 producing wells, none has been fracture-stimulated to increase reservoir deliverability, only acidized. Larger acidized stimulations of the reservoir should provide higher production rates which, in turn, should increase oil 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 proposal supports the possibility of widespread potential of ROZs throughout the Madison Group's Mission Canyon Formation in the Williston Basin. This research builds on established ROZ projects currently underway in other basins, specifically the redevelopment of the San Andres Formation of the Permian Basin. Like the San Andres Formation, the Madison Group has widespread predictability from a geologic and reservoir standpoint. Research suggests that ROZ potential exists in any county in North Dakota where Madison Group production exists. With this vast geographic area, the ultimate reserves of North Dakota's ROZs could be estimated in the millions of recoverable barrels.

This project will seek to exploit existing oil play infrastructure in the western part of the state to revitalize the Mission Canyon play. Over 15,000 Bakken wells penetrate through the Madison Group, which creates opportunities to repurpose obsolete or underutilized Bakken well infrastructure to support Mission Canyon production.

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 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 EOR 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. In the 4.5-year span of Cobra redeveloping the project field's ROZ potential, gross production revenue, production tax revenue, royalty revenue, and gross lease operating expenses are up ~270%. In the project field, company and contracted employment is up 400%. The majority of mineral owners, service providers, and all of the company employees are citizens of North Dakota. Continuing to grow in these categories with increased understanding and predictability in an expedited manner will define project success.

BACKGROUND/QUALIFICATIONS

Summary of Prior Work: Immediately after acquiring the project field in 2018, Cobra began strictly monitoring the backside fluid level of each producing well. Cobra recognized high standing fluid levels throughout the project field, with some wells maintaining fluid levels almost to the surface. Typically, if artificial lift is running at capacity and a column of backside fluid exists, then the formation can deliver more fluid. Cobra recognized a small variance between the fluid levels of static wells to producing wells, which is indicative of a high deliverability reservoir. With this information, Cobra began to upgrade artificial lift capacity to draw down the reservoir. As artificial lift capacity was upgraded, Cobra began to convert the method of artificial lift to the progressive cavity pump (PCP). All the initial wells Cobra monitored in the project field were completed only in the uppermost portion of the Mission Canyon subinterval's pay section. Interestingly, as Cobra began to pump the well's fluid levels down, oil cut slowly began to increase as more total barrels per day were produced. As fluid levels began to fall, Cobra needed to increase formation deliverability to accommodate the upgraded artificial lift. By knowing the petrophysical consistencies of the Mission Canyon subinterval, examining the consistent oil saturations from core analysis, and having comparable core measured porosity and permeability values throughout the gross section, Cobra increased deliverability by recompleting the gross Mission Canyon subinterval in each well. As Cobra began recompleting each well in the entire Mission Canyon subinterval, backside fluid levels again increased, and oil cuts increased or stayed the same. It is notable that oil cuts did not decrease after the basal portions of the Mission Canyon subinterval were recompleted. Cobra had identified the project field as a Type II ROZ reservoir and believes the increased oil cut coupled with increased daily production being produced from deep in the rock section proves depressurization of the ROZs.

Experience and Qualifications: Cobra is a privately held independent oil and gas company based in Wichita Falls, Texas, that 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.

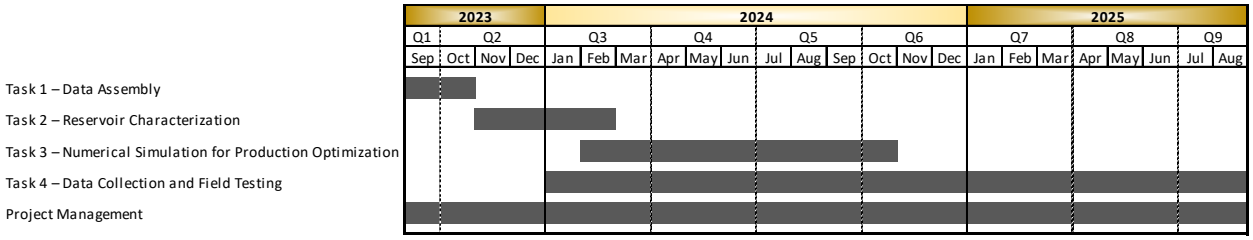
Personnel: Mr. Kyle Gardner, Cobra Vice President of Engineering, will serve as Project Manager and lead Cobra activities. Mr. Gardner will be supported by Mr. Josh Aaron and Mr. Bud Dillard, Cobra Geologists. Mr. Matthew Belobraydic, EERC Assistant Director, Geosciences, will oversee the entire project. Mr. Belobraydic will have project support from Remington Leger, EERC Senior Geoscientist, and Dr. Lu Jin, EERC Distinguished Reservoir Engineer. Project advisors from the EERC include John Harju, EERC Vice President for Strategic Partnerships; James Sorensen, EERC Director of Subsurface R&D; and Bethany Kurz, EERC Director of Analytical Solutions. Resumes of key personnel are included in Appendix B.

PROJECT MANAGEMENT

Overall management and reporting of the project will be handled by subcontractor EERC in close partnership with Cobra. Mr. Kyle Gardner will lead Cobra activities. Mr. Matthew 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. Quarterly reports will be submitted to the North Dakota Industrial Commission (NDIC) 30 days after the end of each calendar quarter 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

This effort is proposed as a 24-month project beginning September 1, 2023, and ending August 31, 2025.



BUDGET

The total estimated cost for the proposed scope of work is $4,000,000. The request from OGRP is $2,000,000. Cobra will provide $2,000,000 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. Undesignated third-party laboratory costs are set aside for potential sampling of existing core or other logging expenses based on project needs as work progresses.

Project Associated Expense	NDIC Share	Cobra Share (cash)	Total Project
Labor – Engineering and Field	$250,000	$355,000	$605,000
Facilities, Equipment, Gathering		$365,000	$365,000
Stimulation	$350,000	$700,000	$1,050,000
Well Service Rigs	$200,000	$225,000	$425,000
Downhole Production Equipment	$200,000	$350,000	$550,000
Travel		$5,000	$5,000
Subcontractor – EERC	$894,120		$894,120
Undesignated Third-Party Laboratory	$105,880		$105,880
Total Project Cost	$2,000,000	$2,000,000	$4,000,000

AFFIDAVIT OF TAX LIABILITY

Cobra Oil & Gas Corporation 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 not been awarded previous funding by NDIC.

APPENDIX A

ENERGY & ENVIRONMENTAL RESEARCH CENTER LETTER OF SUPPORT

EERC
Energy & Environmental Research Center
15 North 23rd Street, Stop 9018 • Grand Forks, ND 58202-9018 • P. 701.777.5000 • F. 701.777.5181
www.undeerc.org

May 19, 2023

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

Dear Mr. Gardner:

Subject: EERC Proposal No. 2023-0157 Entitled "Maximizing Production from Residual Oil Zones in Western 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 investigate methods and strategies to maximize recovery within potential residual oil zones in the Mission Canyon fields.

The estimated project cost is $894,120. 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/rlo

Attachment

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 & gas companies. He currently manages Cobra Oil & Gas Corporation's operations, production & engineering team. He is also leader of Cobra's technical reservoir and petrophysical team. Kyle 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.
- Have planned, executed, and managed the vertical & horizontal drilling & completions of wells Cobra has operated in 9 different states of depths from 4,000' TVD to 18,000' TVD, most of which were wildcats of conventional and unconventional targets.
- Lead petrophysical formation evaluator with emphasis in bypassed conventional pay zones of carbonates.
- Experienced in residual oil zone research and field application in the Permian & Williston Basin's.
- Evaluates Cobra acquisitions and divestitures, creates operational budgeting, manages company operating expenses.
- Experienced in economic evaluation software, Echometer equipment and software, 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 & AAPG.

Bud Dillard
(682) 429.5285
bud@cobraogc.com

EDUCATION

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

WORK 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
- Provide subsurface interpretation and project management as well as conduct 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 softwares
- Worked NW Shelf Delaware Basin, Permian San Andres D in Lea and Eddy Counties, New Mexico; Hardeman Basin, Mississippian Chappel Limestone in Hardeman County, TX

Stivers Consulting, Inc., Graham, Texas—January 2015 – May 2016
Mud Logger
- Analyze/describe rock lithology via microscopy, evaluate hydrocarbon shows, monitor drilling activity, prepare 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 & paleoenvironment for terrestrial rock of the Green River Basin, SW Wyoming, using carbon isotope ratio in sediments

LEADERSHIP & ADDITIONAL ORGANIZATIONS

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, CO_2 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, CO_2 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: Temporary Geoscientist, EERC, UND. Mr. Belobraydic produced geology and geological modeling results for CO_2 storage projects as part of an integrated team of EERC subject matter experts. Specific activities included the following:

- Produced 3D geologic models for CO_2 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 geostastically 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: CO_2 Enhanced Oil Recovery Research Assistant, UND. Mr. Belobraydic researched CO_2 enhanced oil recovery and sequestration potential for the Williston Basin alongside the EERC. Specific activities included the following:

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

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Principal Areas of Expertise

Mr. Leger's principal areas of interest and expertise include geomodeling, with proficiency in geology, geophysics, and unconventional play prospecting; data analysis; structural geology; database management, workplace safety, and resource exploration.

Education and Training

M.S., Geology, University of Tennessee, Knoxville, 2013.
B.S., Geology, Louisiana State University, Batton Rouge, 2009.
Software skills include Petrel E&P and Esri ArcGIS.

Research and Professional Experience

January 2021–Present: Senior Geoscientist, EERC, UND. Mr. Leger interfaces with a diverse team of scientists and engineers to assess project uncertainties in oil and gas development and geologic CO_2 storage. Specific activities include development of geophysical models of the subsurface, regional geological characterization, and petrophysical analysis of geophysical well log data.

July 2013–April 2020: Senior Geologist, Schlumberger, Midland, Texas. Mr. Leger provided in-house geoscience consulting at major players focused on Permian Basin exploration production. Activities included the following:

- Consulted with exploration and production teams in building pad-specific, regional asset, and basinwide geologic models to help companies decrease risk by increasing confidence and understanding of uncertainty of their reservoir models.
- Assisted client in construction of reservoir model of Midland Basin, which is currently used by company's business development team for asset evaluation.
- Implemented Studio database (Schlumberger's data management software) at large independent company working in Permian Basin, thus decreasing uptake time and integration of new database in company.
- Played pivotal role in assisting company in migrating from GeoGraphix to Petrel platform.
- Completed Schlumberger's 3-year fixed-step program: Built reservoir model of Jack Field in Gulf of Mexico using Petrel E&P software.

July 2013–February 2017: Geologist, Houston, Texas. Mr. Leger served as geophysics and geology in-house consultant for Petrel at over five companies working in the Permian Basin, Eagle Ford Basin, Haynesville Basin, and Gulf of Mexico. Specific activities included the following:

- Consulted on developing and improving workflows for asset evaluation, hydrocarbon assessment, and well planning, which resulted in streamlining common task and saving company time.
- Facilitated Petrel on-the-job training for clients helping users decrease uptake time and increased confidence in using the software.
- Conducted presales technical demonstrations.
- Certified lead instructor for seven Petrel Next courses.

- Taught Petrel course at Bureau of Ocean Energy Management in New Orleans.

Publications
Mr. Leger has coauthored numerous professional publications.

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Principal Areas of Expertise

Dr. Jin's principal areas of interest and expertise include reservoir modeling and simulation, CO_2/rich gas enhanced oil recovery (EOR) and associated CO2 storage in both conventional and unconventional reservoirs, engineering optimization, water coning control, and multiphase flow in porous media. He is particularly interested in subsurface oil–water–gas interactions, EOR techniques and development of old oil fields/unconventional resources.

Education and Training

Ph.D., Petroleum Engineering, Louisiana State University, 2013.
M.S., Petroleum Engineering, Louisiana State University, 2009.
B.S., Petroleum Engineering, Northeast Petroleum University, 2005.

Research and Professional Experience

October 2022–Present: Distinguished Reservoir Engineer, EERC, UND. Dr. Jin develops novel methods for renewable energy development in the Williston Basin, including geothermal development in the Bakken Formation and hydrogen conversion in oil reservoirs; leads scientific research activities on machine learning applications, enhanced oil recovery (EOR) technologies, database development for EOR operations, effective simulation methods for unconventional reservoirs, etc. Specific activities include the following:

- Serves as principal investigator for a North Dakota Industrial Commission (NDIC)-sponsored project, "Extending the Shale Revolution from Oil and Gas to Geothermal Development in North Dakota."
- Serves as principal investigator for an NDIC-sponsored project, "Examination of In-situ Hydrogen Conversion in Oil Reservoirs."
- Continues to serve as task lead and key reservoir engineer for a U.S. Department of Energy (DOE)-sponsored project, "CO_2 Enhanced Oil Recovery Improvement in Conventional Fields Using Rich Gas."
- Continues to serve as task lead and key reservoir engineer for a DOE-sponsored project, "Improving Enhanced Oil Recovery Performance Through Data Analytics and Next-Generation Controllable Completions."
- Serves as task lead and key reservoir engineer for an NDIC-sponsored project, "Unitized Legacy Oil Fields: Prototypes for Revitalizing Conventional Oil Fields in North Dakota."

January 2020–September 2022: Principal Reservoir Engineer, EERC, UND. Dr. Jin develops dynamic numerical models for CO_2/rich gas enhanced oil recovery in different reservoirs; oversees technical areas in reservoir engineering, including conventional, unconventional and enhanced oil and gas production, the geologic storage of CO_2 and natural gas, natural resource development, geocellular modeling, numerical simulation. Specific activities include the following:

- Serves as task lead and key reservoir engineer for a U.S. Department of Energy (DOE)-sponsored project, "CO_2 Enhanced Oil Recovery Improvement in Conventional Fields Using Rich Gas."

- Serves as task lead and key reservoir engineer for a DOE-sponsored project, "Improving Enhanced Oil Recovery Performance Through Data Analytics and Next-Generation Controllable Completions."
- Serves as key reservoir engineer for a DOE-sponsored project, "Bakken Rich Gas Enhanced Oil Recovery Project."
- Serves as co-principal investigator for an NDIC-sponsored project, "Exploration of Opportunities and Challenges for a North Dakota Petrochemical Industry."

August 2018–December 2019: Senior Reservoir Engineer, EERC, UND. Dr. Jin develops dynamic numerical models for CO_2 flow monitoring and prediction in different reservoirs; designs well testing plans for both producers and injectors to support the long-term success of field operations; develops innovative fractured reservoir models for the Bakken unconventional petroleum system; and serves as a simulation task lead for a variety of seismic projects. Specific activities include the following:

- Served as task lead and key reservoir engineer for a DOE-sponsored project, "Joint Inversion of Time-Lapse Seismic Data."
- Served as key reservoir engineer for a DOE-sponsored project, "Scalable, Automated, Semi-permanent Seismic Method for Detecting CO_2 Plume Extent During Geological CO_2 Injection – Phase II."

February 2015–July 2018: Reservoir Engineer, Reservoir Modeling and Simulation, EERC, UND. Dr. Jin's responsibilities include developing geophysical models of the subsurface and running dynamic simulations to determine the long-term fate of produced/injected fluids, including hydrocarbons, CO_2 storage, and brine, using oil and gas industry simulation software. Specific activities include the following:

- Served as task lead and key reservoir engineer for a DOE-sponsored project, "Plains CO_2 Reduction (PCOR) Partnership Phase III – Bell Creek Test Site."
- Served as Co-PI and key reservoir engineer for a DOE-sponsored project, "Improved Characterization and Modeling of Tight Oil Formations for CO_2 Enhanced Oil Recovery Potential and Storage Capacity Estimation."
- Served as key reservoir engineer for a DOE-sponsored project, "Scalable, Automated, Semi-permanent Seismic Method for Detecting CO_2 Plume Extent During Geological CO_2 Injection – Phase I."

January 2014–January 2015: Reservoir Engineer, InPetro Technologies, Inc., Houston, Texas. Dr. Jin's responsibilities included developing simulation and analytical models for unconventional reservoir development, especially for shale oil reservoirs; analyzing fluid PVT (pressure, volume, temperature) change during depletion and considering pore-size distribution (PSD) in simulations. Application of a new model in the Eagle Ford and Bakken Formations shows that oil reserves could be improved as much as 30% by integrating PVT and PSD effects.

August 2007–December 2013: Research Assistant and Reservoir Consultant, Department of Petroleum Engineering, Louisiana State University (LSU), Baton Rouge, Louisiana. Dr. Jin's responsibilities included modeling and evaluating the performance of Downhole Water Loop (DWL) well system in different oil fields, developing economical models for evaluation of the DWL system in various reservoir and market conditions, and identifying best reservoir candidates for the system; oil production rate could be improved as much as 200%. Constructed software (toolbox) using ECLIPSE and VBA for complex well system simulation, applied batch processing technology in simulation, achieved automatic task queuing, and reduced simulation time 67%.

- **January 2013–December 2013**: Reservoir Consultant, Joint Industrial Program (JIP), LSU, and Pluspetrol, Baton Rouge, Louisiana. Dr. Jin's responsibilities included simulating cold production of heavy oil in Massambala Field, Angola, identifying the mechanisms of high water cut in current wells,

optimizing the perforation length for conventional wells, and proposing two well systems, which could improve cumulative oil up to 80% or reduce produced water 75%, respectively.

- **May 2012–August 2012**: Internship, High Plains Operating Company, LLC (HPOC), San Francisco, California. Dr. Jin's responsibilities included simulating and analyzing the extra water production problems in the Ojo Encino Field, New Mexico, designing a DWS well system to produce oil from the thick transition zone, which could improve oil production rate by up to 20%.
- **May 2011–August 2011**: Internship, JIP, LSU, and HPOC, Baton Rouge, Louisiana. Dr. Jin's responsibilities included simulating performance of vertical and horizontal wells in the Ojo Encino Field, New Mexico, diagnosing water coning/cresting problems in the thick transition zone, determining the best location for water injection to minimize pressure interference, and suggesting well type to develop the field, which saved costs up to 30%.
- **January 2011–January 2013**: Senior Teaching Assistant, Drilling Fluids Laboratory, LSU, Baton Rouge, Louisiana. Served as lecturer and oversaw four teaching assistants and 80–100 students each year as well as supervised three senior students completing their senior design projects.

September 2005–August 2007: Production Consultant, JIP, China University of Petroleum, and CNPC. Dr. Jin's responsibilities included optimizing a large gas pipeline network in China, proposing new optimization algorithm and programming a software package for best operation in different conditions, reducing operational cost up to 23% (more than $20,000/day).

Professional Activities

Member, Society of Petroleum Engineers

Publications

Dr. Jin has authored or coauthored numerous peer-reviewed and other professional publications.

JAMES A. SORENSEN
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Principal Areas of Expertise
Mr. Sorensen's primary areas of interest and expertise are enhanced oil recovery (EOR) in unconventional tight oil formations, CO_2 utilization and storage in geologic formations, and tight oil resource assessment and development.

Education and Training
M.Eng., Petroleum Engineering, University of North Dakota, 2020.
B.S., Geology, University of North Dakota, 1991.

Research and Professional Experience
October 2019–Present: Director of Subsurface Research and Development, EERC, UND. Mr. Sorensen is responsible for developing and managing programs and projects focused on conventional, unconventional, and enhanced oil and gas production; the geological storage of CO_2; geothermal; and other energy and environmental research.

July 2018–September 2019: Assistant Director for Subsurface Strategies, EERC, UND. Mr. Sorensen developed business opportunities, provided technical support and guidance regarding emerging areas of research, and served as a principal investigator and task manager for projects related to the sequestration of CO_2 in geologic media and the sustainable development of tight oil resources.

1999–July 2018: Principal Geologist, EERC, UND. Mr. Sorensen served as manager and co-principal investigator for programs to develop strategies for CO_2 utilization and storage. He also led research focused on enhanced oil recovery (EOR) in the Bakken.

1997–1999: Program Manager, EERC, UND. Mr. Sorensen managed projects focused on produced water management and environmental fate of natural gas-processing chemicals.

1993–1997: Geologist, EERC, UND. Mr. Sorensen conducted field-based hydrogeologic investigations focused on natural gas production sites.

1991–1993: Research Specialist, EERC, UND. Mr. Sorensen assembled and maintained comprehensive databases related to oil and gas drilling, production, and waste management.

Professional Activities
Member, Society of Petroleum Engineers

Publications
Mr. Sorensen has coauthored nearly 200 publications.

DR. JOHN A. HARJU
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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
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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 carbon capture, utilization, and storage. 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.

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.

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