



October 1, 2024

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

Dear Mr. Haase:

Subject: EERC Proposal No. 2025-0049 Entitled “Coal Creek Carbon Capture: Geologic CO<sub>2</sub> Storage Complex Development Add-On”

The Energy & Environmental Research Center (EERC) was awarded \$38 million from the U.S. Department of Energy (DOE) in September of 2023 through the DOE Carbon Storage Assurance Facility Enterprise (CarbonSAFE) Initiative to characterize and permit a geologic carbon dioxide (CO<sub>2</sub>) storage complex in central North Dakota to store CO<sub>2</sub> captured from the Coal Creek Station power plant. DOE approved an additional \$5.15 million of funding in September 2024 to support data characterization activities. The funding being requested from the Lignite Research, Development and Marketing Program (LRDMP) would be used as cost share for this additional funding from the DOE. The requested funding would support coring, injection testing, and materials compatibility modeling necessary to address data gaps and uncertainties identified as part of ongoing efforts funded by DOE, Rainbow Energy Center, and LRDMP.

The \$100 application fee for this proposal is provided through ACH Transaction Number 280730.

This transmittal letter represents a binding commitment by the EERC to complete the project described in this proposal. If you have any questions, please contact me by telephone at (701) 777-5344 or by e-mail at [alivers@undeerc.org](mailto:alivers@undeerc.org).

Sincerely,

DocuSigned by:

Amanda J. Alivers-Douglas  
Assistant Director for Integrated Subsurface  
Projects

Approved by:

DocuSigned by:

Charles D. Gorecki, CEO  
Energy & Environmental Research Center

AJL/rlo

Attachment

c: Erin Stieg, North Dakota Industrial Commission

Lignite Research, Development  
and Marketing Program

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North Dakota Industrial  
Commission

**Application**

**Project Title: Coal Creek Carbon Capture:  
Geologic CO<sub>2</sub> Storage Complex Development  
Add-On**

**Applicant: University of North Dakota Energy &  
Environmental Research Center**

**Principal Investigator: Amanda J. Livers-Douglas**

**Date of Application: 10/1/2024**

**Amount of Request: \$5,150,874**

**Total Amount of Proposed Project: \$10,945,607**

**Duration of Project: 23 months**

**Point of Contact (POC): Amanda J.  
Livers-Douglas**

**POC Telephone: (701) 777-5344**

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**POC Address: 15 North 23rd Street, Stop 9018**

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## ABSTRACT

**Objective:** The proposed add-on scope of work including coring, injection testing, and materials compatibility modeling will support the overall project objective, to advance development of carbon capture and storage at Coal Creek Station by characterizing and obtaining a permit for a storage complex capable of accommodating 200 MMt of CO<sub>2</sub>. The goal of collecting additional whole core and performing water injection tests is to reduce uncertainties in the prospective storage formations and provide the data necessary to design, optimize, and permit a storage complex to meet the target injection volumes. The objective of the materials compatibility modeling is to determine suitable materials required to permit and construct project wells and other surface infrastructure.

**Expected Results:** Results from the proposed coring and injection testing will comprise petrophysical properties and injectivity data that are necessary to address data gaps and associated geologic uncertainty for the potential storage reservoirs, particularly the carbonate reservoirs. Materials compatibility modeling will result in data and information necessary to select suitable materials for project wells and other surface infrastructure. These proposed efforts will support the successful completion of Stage 2, which is anticipated to result in a fully characterized and permitted geologic CO<sub>2</sub> storage complex that is ready to transition to construction and operation.

**Duration:** 23 months (November 18, 2024 – October 1, 2026)

**Total Project Cost:** The total value of the project is \$61,333,508 (Stage 1: \$2,700,000, Stage 2: \$47,687,901, and Add-On: \$10,945,607). \$5,150,874 is being requested from LRDMP to fund the proposed add-on scope of work. Project partner Rainbow Energy Center (REC) will provide \$643,859, and DOE will provide \$5,150,874 to fund the proposed add-on scope of work.

**Participants:** The project lead is the EERC, and the project will be conducted in partnership with LRDMP, DOE, REC, and Naset Consulting Service, Inc.

## PROJECT SUMMARY

The Energy & Environmental Research Center (EERC) and project partners Rainbow Energy Center (REC) and Neset Consulting Service, Inc. (Neset) were awarded \$38 million from the U.S. Department of Energy (DOE) in September of 2023 through the DOE Carbon Storage Assurance Facility Enterprise (CarbonSAFE) Initiative to characterize and permit a geologic carbon dioxide (CO<sub>2</sub>) storage complex in central North Dakota to store up to 200 million metric tons (MMt) of CO<sub>2</sub> captured from Coal Creek Station power plant (Coal Creek). Project partner REC and the Lignite Research, Development and Marketing Program (LRDMP) have each provided \$6.1 million to date to fund this effort.

Successful completion of the project will result in a fully characterized and permitted storage complex that is ready to transition to construction and operation. The project will advance the development of carbon capture and storage (CCS) at Coal Creek. Implementation of CCS at Coal Creek would reduce the CO<sub>2</sub> emissions from the plant by 95%, representing a 19% reduction of CO<sub>2</sub> emissions from North Dakota's stationary sources and provide Coal Creek with a pathway to low-carbon energy, resulting in resiliency against future legislation, regulations, and/or taxes associated with carbon emissions by providing safe, reliable, affordable, environmentally prudent baseload energy generation for the United States. Additionally, the development of CCS at Coal Creek will create approximately 35–40 long-term jobs and over 2000 direct/indirect short-term construction jobs. The project will facilitate attracting, training, and retaining a skilled and well-qualified workforce for these new and existing jobs. The proposed project is also designed to provide internship opportunities to students from minority-serving institutions and tribal colleges.

This existing project consists of two stages of work. Stage 1 comprised evaluation of existing 2D seismic data, geologic modeling, and CO<sub>2</sub> injection simulations to inform Stage 2 site characterization activities including design of a 3D seismic survey and placement and design of a stratigraphic test well

and associated coring, logging, and testing plans. Stage 1 also included materials testing to help inform the stratigraphic test well design.

The objective of Stage 2 is to fully characterize and obtain a permit for one or more geologic CO<sub>2</sub> storage facilities sufficient for storing 200 MMt of CO<sub>2</sub>. As part of Stage 2, the EERC and project team will prepare and submit applications for underground injection control (UIC) Class VI storage facility permit(s) sufficient for the Coal Creek development scenario. Near-surface and subsurface data will be acquired and analyzed to fully characterize the proposed storage complex. The EERC will oversee acquisition and processing of 3D seismic data; drilling, coring, logging, testing, and completion of a stratigraphic test well; and collection of baseline water-quality data from underground sources of drinking water. Geologic modeling and reservoir simulation will incorporate characterization data to delineate the extent of pore space necessary to store CO<sub>2</sub> and determine the area of review (AOR). In addition, the project will include a pipeline front-end engineering and design (FEED) study and assess National Environmental Policy Act (NEPA)-related issues for the project's capture, transport, and storage site.

Stage 1 was successfully completed in May 2024. Results from Stage 1 highlighted the need for additional site characterization and materials compatibility evaluation to achieve the Stage 2 objective. While Stage 1 results show the target storage formations have capacity to store up to 200 MMt of CO<sub>2</sub> in a stacked storage scenario where CO<sub>2</sub> is injected into multiple stacked reservoirs, low injectivity rates and geologic uncertainties within deeper storage prospects, such as the Interlake–Red River and Black Island–Deadwood Formations and the Madison Group, require additional characterization. As part of this proposed add-on scope of work (SOW), the EERC is proposing collection of additional whole core and injection testing to reduce uncertainties in these prospective storage formations and provide the data necessary to design, optimize, and permit a storage complex to meet the target injection volumes.

Based on findings from Stage 1 efforts, the EERC is also proposing additional evaluation of materials compatibility to determine appropriate casing alloy and tubular design for Class VI injection wells.

DOE approved \$5.151 million of funding in September 2024 to support additional site characterization efforts. The EERC is requesting \$5.151 million in funding from LRDMP to match this DOE funding. REC is also providing an additional \$644k to fund this effort.

## **PROJECT DESCRIPTION**

### **Objectives**

The proposed add-on SOW including coring, injection testing, and materials compatibility modeling will support the overall project objective, to advance development of CCS at Coal Creek by characterizing and obtaining a permit for a storage complex capable of accommodating 200 MMt of CO<sub>2</sub>. The goal of collecting additional whole core and performing water injection tests is to reduce uncertainties in the prospective storage formations and provide the data necessary to design, optimize, and permit a storage complex to meet the target injection volumes. The objective of the materials compatibility modeling is to determine suitable materials required to design and permit project wells and other surface infrastructure.

### **Methodology**

The existing Stage 2 SOW funded by LRDMP, DOE, and REC is divided into nine tasks. Task 1.0, a project management, planning, and reporting activity, spans the duration of the project and ensures that all subsequent tasks and activities are being completed according to specified timelines and provides for both LRDMP and DOE reporting. Task 2.0 covers NEPA compliance and submittal of an environmental information volume (EIV). Task 3.0 includes development of permitting documents necessary to construct and operate a commercial geologic storage complex. Permitting documents will be developed specific to North Dakota's UIC Class VI primacy program. Modeling and simulation will be conducted as part of Task 3.0 to address UIC Class VI regulations, predict the boundaries of the injected CO<sub>2</sub> plumes at

the proposed site, and determine each AOR to support Class VI permits and inform development of monitoring plans. Task 4.0 includes activities required to characterize the CO<sub>2</sub> storage complex of the proposed project, including drilling/coring/testing/logging one new stratigraphic test well, acquisition and analysis of a new 3D seismic survey, and characterization of core and data from the new stratigraphic test well and offset well(s). Task 5.0 will yield a storage field development plan to inform commercialization of the storage hub. Task 6.0 will conduct a CO<sub>2</sub> source feasibility study to demonstrate due diligence and include all necessary information to support development of the Class VI permit applications. The CO<sub>2</sub> source feasibility study will build on ongoing and existing FEED studies conducted by the EERC and project partners. Task 7.0 will initiate a pipeline FEED study to include pipelines needed to connect the CO<sub>2</sub> source to the storage site. Task 8.0 includes direct collaborative efforts with project partners for development of business and financial plans as entry requirements for future DOE CarbonSAFE funding. Task 9.0 includes a societal considerations and impacts assessment and plans that incorporate diversity, equity, inclusion, and accessibility; the Justice40 Initiative; community, labor, and stakeholder engagement; and quality jobs.

The proposed add-on SOW consists of coring, injection testing, and materials compatibility modeling to support Stage 2 Task 3.0 – UIC Class VI “Authorization to Construct” and Task 4.0 – Detailed Site Characterization of a Commercial-Scale CO<sub>2</sub> Storage Site.

#### ***Stratigraphic Test Well Coring and Injection Test***

Stage 1 geologic modeling and simulation efforts highlighted the data gaps and associated geologic uncertainty for the potential storage reservoirs, particularly the carbonate reservoirs, the Interlake–Red River Formation and Madison Group, and the deepest target of interest, the Black Island–Deadwood Formations. To help reduce this uncertainty and better characterize these reservoirs the EERC is proposing to conduct a water injection test within these zones in the stratigraphic test well and collect additional whole core from these intervals.



The EERC will collaborate with Naset to select and contract the pertinent services to perform an injection test within the Interlake-Red River and Black Island–Deadwood Formations and Madison Group in the stratigraphic test well. An independent third party will interpret the injection test results. The resulting interpreted dataset, such as permeability and pressure, will be used to refine the existing 3D geologic models and calibrate reservoir simulation parameters. Data derived from this injection test and analysis of whole core data will not only support characterization of the site, it will inform the suitability of these reservoirs for geologic CO<sub>2</sub> storage across the state.

### ***Materials Compatibility Modeling***

Findings from the Stage 1 materials recommendation and testing demonstrated the need for additional evaluation of materials compatibility to determine appropriate casing alloy and tubular design for Class VI injection wells. This SOW will include additional modeling and consultation with industry experts with carbon capture, utilization, and storage operational experience. This effort will result in a determination of suitable materials and demonstration of material compatibility required to design and permit project wells and other surface infrastructure. While the results of this study will be project specific, this effort will establish a framework for demonstration of material compatibility that will benefit other project developers looking to design and permit geologic CO<sub>2</sub> storage projects in the state.

### **Anticipated Results**

Results from the proposed coring and injection testing will comprise petrophysical properties and injectivity data that are needed to reduce uncertainties and design, optimize, and permit a storage complex to meet the target injection volumes. Materials compatibility modeling will result in determination of suitable materials and demonstration of material compatibility required to design and permit project wells and other surface infrastructure. These efforts will support the successful completion of Stage 2, which is anticipated to result in a fully characterized and permitted geologic CO<sub>2</sub> storage complex that is ready to transition to construction and operation.

Successful completion of this project and implementation of CCS at Coal Creek would provide a pathway to low-carbon energy, which would provide Coal Creek with resiliency against future legislation, regulations, and/or taxes associated with carbon emissions. Development of CCS at Coal Creek would allow Coal Creek to continue to provide safe, reliable, affordable, and environmentally prudent baseload energy. Successful completion of the proposed project would also position Coal Creek to be eligible to apply for hundreds of millions of dollars through loan programs or funding made available through the Bipartisan Infrastructure Law and Inflation Reduction Act to support construction of capture facilities.

**Facilities, Resources, and Techniques to Be Used and Their Availability and Capability**

The EERC has all necessary office and computer resources immediately available to complete the proposed SOW. Computer resources include industry-standard modeling, simulation, and petrophysical analysis software and high-performance workstations capable of running this software. Project partner Naset has a state-of-the-art facility, including office space, a full-service shop, total on-site electrical power backup, and a geosteering operations center capable of providing service across the entire Williston Basin and beyond. These capabilities ensure Naset will be able to provide drilling support services no matter when the wells are ultimately drilled. Project partner REC has extensive office and computer resources at its headquarters in Bismarck, North Dakota. The field activities proposed as part of the Stage 2 add-on will be constrained to the existing well pad on land owned by North American Coal Corporation (NACCO). The EERC has a field site access commitment letter from NACCO (Appendix A).

The individual partners mentioned within the proposed project represent decades of experience in drilling, geological consulting services, subsurface data collection, CCS project development, and coal plant operations. All project participants have committed the necessary resources to execute this project, as evidenced by the letters of support in Appendix A.

The industry-standard techniques to be used to accomplish the proposed SOW are discussed in the Methodology section.

### **Environmental and Economic Impacts while Project Is Underway**

Field activities for the proposed add-on SOW will include coring and water injection testing. This work will be conducted in accordance with state and local laws, and field crews will follow industry-standard safety practices. No permanent adverse environmental impacts associated with field activities are anticipated.

These activities will occur on the existing well pad in the newly drilled stratigraphic test well. These activities will involve a drilling and workover rig, trailers, logging trucks, and other heavy equipment. The coring will be completed over a 2-month period. The injection testing is anticipated to take around a month. No area outside this 450-by-450-ft well pad and access road are anticipated to be disturbed. The coring and injection test will be carried out under a permit issued by the North Dakota Industrial Commission (NDIC).

### **Ultimate Technological and Economic Impacts**

The lignite-fired power plants in North Dakota present an opportunity to demonstrate the economic feasibility of large-scale CCS for the existing domestic coal fleet, as they are optimally located near both appropriate geologic storage and oil fields amenable to enhanced oil recovery (EOR) operations. The economic health of central North Dakota is tied to energy jobs in the area. Currently, the lignite industry directly employs 3623 people, with another 9500 indirect employees supported by the industry, accounting for over \$5.4 billion in economic impact. Technology advances that continue the responsible use of lignite and bring new industries to the region are critically needed to sustain and grow these jobs. Based on a recent study by the EERC, the economic impact to a state such as North Dakota from development of a new carbon capture and EOR industry would be tremendous if deployed statewide: \$2.5 billion–\$3.0 billion in annual economic activity, state revenue increased by \$160 million per year,

and creation of approximately 8000 long-term jobs (Stanislawski et al., 2019). At Coal Creek alone, approximately 35–40 direct jobs will be created.

With this project, the project team aims to perform the work necessary to develop large-scale CCS associated with Coal Creek that will increase sustainability of energy production and delivery. This project will fully characterize the site and obtain the permits for a storage complex for storage of up to 200 MMt of CO<sub>2</sub>, which will accommodate CO<sub>2</sub> captured from Coal Creek and will have excess capacity for additional future sources that could provide further economic opportunity, optionality, and resilience for both the facility and the region.

To date, CO<sub>2</sub> storage evaluations and operations have focused exclusively on sandstone formations. Carbonate formations also offer significant CO<sub>2</sub> storage potential in North Dakota but have not yet been sufficiently evaluated to realize their potential. This project will include characterization of several carbonate formations for CO<sub>2</sub> storage. Understanding the storage capacity and technical challenges associated with CO<sub>2</sub> storage in carbonates will provide the critical information needed to support the business case for other CCS projects looking to store CO<sub>2</sub> in a carbonate formation. As the number of commercial CCS projects being developed in North Dakota increases, CO<sub>2</sub> storage in carbonate reservoirs will be absolutely vital for optimizing use of pore space. Future CCS projects in North Dakota will benefit through the key information relating to the storage potential and characteristics of carbonate formations in the Williston Basin that will be generated through the proposed work.

### **Why the Project Is Needed**

The polar vortex (which caused severe limitations to wind power generation capacity and natural gas availability) that swept through the Midwest in early 2019 and the challenges faced by the Electric Reliability Council of Texas in 2021 are profound reminders of why we need to keep our entire power generation mix on the table; CCS can serve as a long-term solution to carbon emissions while also

providing firm baseload generation to mitigate the impact of intermittent supply from renewables on grid reliability. Ultimately, Coal Creek can serve as a model and example for the rest of the nation's existing coal fleet and provide baseload power with reduced CO<sub>2</sub> emissions.

Investing in this project ensures that this initiative can move down the project development path, and anticipated subsequent projects in North Dakota will be better-informed and more likely to succeed and make progress toward Governor Doug Burgum's goal of North Dakota carbon neutrality by 2030.

### **STANDARDS OF SUCCESS**

The proposed study is to advance development of CCS at Coal Creek. The study will result in a fully characterized and permitted storage complex that is ready to move to construction. Successful outcomes for the project include obtaining a North Dakota UIC Class VI storage facility permit(s) for the storage complex. Additionally, at the end of the project, all required leases, development plans, business plans, and other agreements related to the storage complex will be in place to inform a final investment decision. By the end of the project, Coal Creek will meet the prerequisites to apply for additional funding through the DOE CarbonSAFE project to support construction of pipeline, compressors, injection wells, and other associated infrastructure.

### **BACKGROUND/QUALIFICATIONS**

#### **Background**

The project team completed Stage 1, including evaluating the site for the ability to geologically store up to 200 MMt of CO<sub>2</sub>. This effort resulted in 2D seismic interpretations, geologic models, and reservoir simulation results that are being used to inform Stage 2 data characterization and permitting activities. Stage 1 work leveraged prior regional characterization conducted by the EERC in partnership with Midwest AgEnergy (MAG) to characterize, design, and develop a UIC Class VI storage facility permit application for the Brook Creek Formation within the project area to store CO<sub>2</sub> from the Blue Flint Ethanol plant.

Stage 1 efforts were also informed by geologic characterization that was previously completed as part of a separate CarbonSAFE Phase II North Dakota integrated carbon storage complex feasibility study funded by DOE associated with Project Tundra showed the potential of permanently and safely storing at least 50 MMt of CO<sub>2</sub> within 30 years within a CO<sub>2</sub> storage complex approximately 20 miles southwest of Coal Creek. The results of that project show that two of the prospective formations within the storage complex, the Broom Creek and Black Island–Deadwood Formations, are capable of storing large amounts of CO<sub>2</sub>. Datasets generated from that project include the drilling, coring, logging, testing, sampling, and characterization of a stratigraphic test well (BNI 1) and interpretation of an existing 9-mi<sup>2</sup> 3D seismic survey.

Additionally, efforts associated with Project Tundra eventually led to a CarbonSAFE Phase III award. As part of the ongoing CarbonSAFE Phase III efforts associated with Project Tundra, geologic characterization data were collected from drilling, coring, logging, testing, and sampling of two recent stratigraphic test wells approximately 20 miles to the southwest of Coal Creek (J-LOC 1 and Liberty 1). An injection test was also conducted at this site along with a 12-mi<sup>2</sup> 3D seismic survey. The characterization data collected from Project Tundra was used to complement the information available from MAG.

Data and learnings from these efforts will be applied to execution of Stage 2 and add-on scope activities.

### **Qualifications**

The EERC will lead the project, with support from project partners REC and Naset. The principal investigator (PI) is Ms. Amanda Livers-Douglas, EERC Assistant Director for Integrated Subsurface Projects. In this role, she will handle project management, planning, and reporting; coordinate and direct subcontractor activities; and ensure successful completion of the project on schedule and budget. Ms. Livers-Douglas has served as PI on several commercial CCS projects and as task lead on DOE projects

at the EERC. She has broad expertise in CO<sub>2</sub> geologic storage, including geologic site characterization, regulatory compliance, and North Dakota UIC Class VI permitting and will help guide project activities.

Each of the project tasks will be led by qualified individuals from the EERC who will work with the project partners as appropriate to accomplish task goals and corresponding project goals. Figure 1 shows the task structure and key personnel. The add-on scope will be led by Caitlin Olsen and Agustinus Zandy as part of Phase 2 Tasks 3.0 and 4.0. Resumes of key personnel are provided in Appendix B. The project team also includes multiple project advisors with decades of combined CCS experience and/or relevant industry experience who will support the PI. Four project advisors from project partners Neset and REC will also advise the PI on technical and nontechnical issues to meet the proposed project goals and timelines.

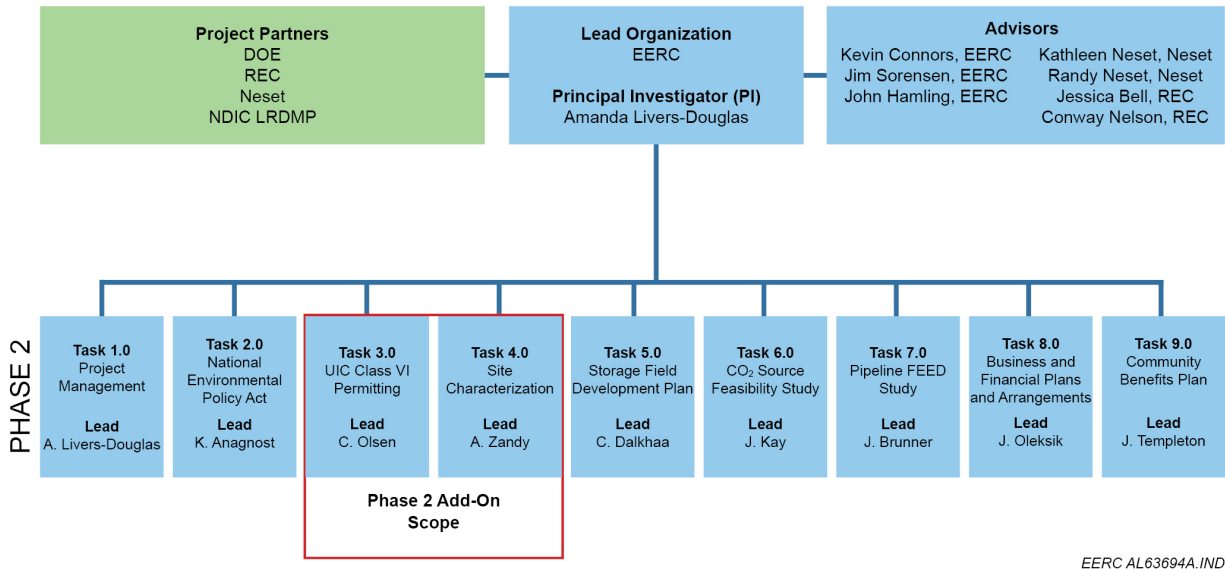


Figure 1. Project organizational chart showing key personnel.

A wide variety of previous work has given the EERC the experience and capabilities necessary to lead and carry out the proposed project. The research, field experience, and partnership investment that have been built through the EERC-led Plains CO<sub>2</sub> Reduction (PCOR) Partnership enable the EERC to confidently propose and execute the proposed project. The PCOR Partnership has covered all aspects of

developing CO<sub>2</sub> storage projects and has led directly to new CCS storage programs in the region. For example, the EERC worked with Red Trail Energy to obtain a UIC Class VI storage facility permit and assisted with implementing the project, which became operational in June 2022. Red Trail Energy's Class VI permit was the first issued by North Dakota and the third issued in the United States. Additionally, the EERC-led DOE CarbonSAFE Phase II and Phase III projects in partnership with Project Tundra resulted in UIC Class VI storage facility permits to accommodate 4 MMT/year of geologic storage for another lignite power generation facility in North Dakota, Milton R. Young Station. Moreover, the EERC has been exploring development of CCS around Blue Flint Ethanol and Coal Creek through prefeasibility, feasibility, and site characterization studies in collaboration with MAG since 2019. Lastly, the EERC previously conducted a pre-FEED capture study and is currently leading a capture FEED study at Coal Creek in collaboration with REC.

REC owns and operates Coal Creek and has committed to developing the world's largest postcombustion CO<sub>2</sub> capture facility, which will capture 95% of Coal Creek's CO<sub>2</sub> emissions, totaling 8.9 MMT/year. This substantial investment in resources and infrastructure goes hand in hand with the proposed effort to characterize and develop the CO<sub>2</sub> storage resources for the site. REC also has strategic partnerships outside of the proposed work that are key to the success of the larger CCS program. REC has agreements with MAG to utilize geologic and demographic information collected by MAG to advance development of CCS at Coal Creek. REC's partnership with NACCO provides the land access necessary to characterize and permit the storage complex site proposed by this work. Finally, REC has committed to providing the appropriate cost share and resources necessary to complete the proposed effort, as described in its letter of support (Appendix A).

Neset has provided drilling, production, and geological consulting services to operators in the Williston Basin for over 40 years. Neset will provide the resources and know-how to plan, permit, and complete the characterization well to be drilled as part of this proposed effort. Neset's consultants will



ensure high-quality data and samples are collected from the characterization wells and use its experience to maximize the collection of samples and data from multiple horizons. Naset has committed to providing the appropriate personnel and resources needed for the project, as described in its attached letter of support.

The EERC and Naset are currently partnered on efforts funded by North Dakota to characterize the potential to develop underground storage of natural gas and related gases in subsurface salt formations. Through these efforts, the EERC and Naset have experience working together to budget, plan, and carry out well drilling, coring, and logging in the Williston Basin, experience that is directly applicable to the proposed effort.

#### **VALUE TO NORTH DAKOTA**

Establishment of CCS at Coal Creek will reduce 95% of the CO<sub>2</sub> emissions from the plant, which represents a 19% reduction of CO<sub>2</sub> from North Dakota's stationary sources, providing an important step in helping reach Governor Burgum's goal for North Dakota to achieve net-zero carbon emissions by 2030. Capturing emissions from coal-based processes at REC will remove greenhouse gases that would otherwise enter the atmosphere; improve resiliency of Coal Creek against future legislation, regulations, and/or taxes associated with carbon emissions; allow Coal Creek to continue to provide safe, reliable, affordable, and environmentally prudent baseload energy; and contribute to continued energy independence in domestic markets. If future project phases are realized and the project is ultimately implemented, the life of the plant will be extended, ensuring continued quality jobs in the region. Coal Creek and NACCO's Falkirk Mine, which feeds the plant, support 700 direct/indirect jobs. Development of CCS at Coal Creek will result in approximately 35–40 direct long-term jobs and over 2000 direct/indirect short-term construction jobs.

Additionally, results from the project including subsurface data and information related to the storage capacity and technical challenges associated with CO<sub>2</sub> storage in carbonates will greatly benefit

other CCS project developers in North Dakota. This information will be made publicly available through the NDIC Department of Mineral Resources website and project reports and can be used to support the development of future projects.

## **MANAGEMENT**

The project team comprises researchers from the EERC and staff and project advisors from Naset and REC. The EERC will schedule regular internal and external meetings with project staff and advisors to ensure that the project is conducted using acceptable scientific methodologies and practices in accordance with the project plan (budget, schedule, deliverables, and milestones) and is meeting quality objectives. The EERC will keep all partners informed of project progress, coordinate activities as necessary for the execution of a successful project, and be responsible for timely submission of all project deliverables and transfer of data and products to the team.

REC will coordinate efforts to support site characterization, including providing existing characterization data and access to land within the area of interest. REC will also assist with NEPA documentation and business financial plans and arrangements.

Naset will serve as primary point of contact for obtaining quotes and materials for drilling operations and help plan and participate in community outreach events.

Project progress will be measured by completion of milestones and deliverables as noted in the project timeline in Figure 2. The milestones and deliverables are at key times during the design, site characterization, permitting, and commercial development components of the project. The deliverables are indicated where key documents and reports are noted, while the milestones are noted as key accomplishments during the project's progress. Semiannual reports will be provided to LRDMP throughout the duration of the project. A final report will be provided in addition to interim reports including a geologic catalog of materials, detailed site and subsurface characterization storage resource/capacity assessment, and UIC Class VI storage facility permit application(s).

### TIMETABLE

The project timeline for the proposed add-on SOW will align with the Stage 2 timeline shown in Figure 2, which had a start date of October 1, 2023. The Stage 2 add-on SOW will be a 23-month effort, with a projected start date of November 2024.

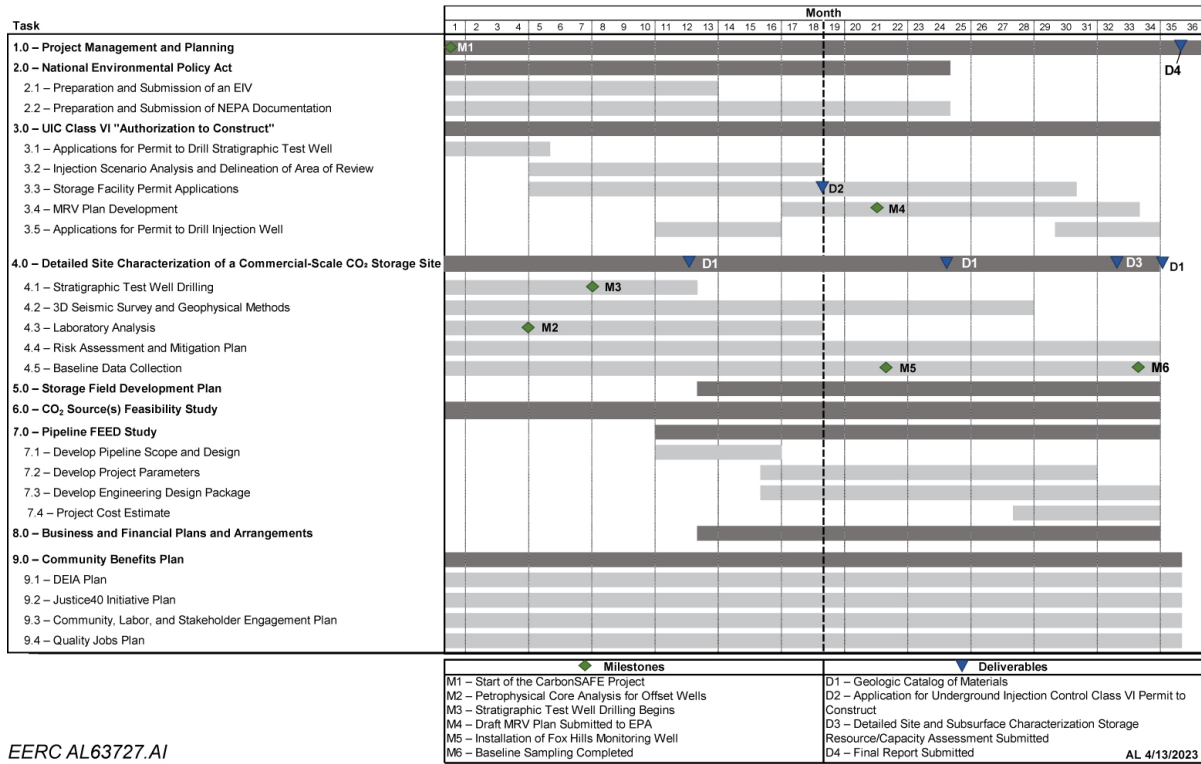


Figure 2. Project Gantt chart for Stage 2. Stage 2 add-on scope will be performed as part of Task 3.0 – UIC Class VI “Authorization to Construct” and Task 4.0 – Detailed Site Characterization of a Commercial-Scale CO<sub>2</sub> Storage Site. Note: deliverables for Stage 2 are prescribed by DOE.

### BUDGET AND MATCHING FUNDS

Table 1 shows a summary of the proposed budget. Letters of commitment for the cost share from REC can be found in Appendix A. Budget notes can be found in Appendix C. If less funding is available than requested, changes to the scope will be considered.

**Table 1. Budget Breakdown**

<b>Project Associated Expense</b>	<b>NDIC Share (Cash)</b>	<b>DOE Share (Cash)</b>	<b>Commercial Share (Cash)</b>	<b>Total Project</b>
<b>Labor</b>	\$482,659	\$0	\$0	\$482,659
<b>Travel</b>	\$33,858	\$0	\$0	\$33,858
<b>Supplies</b>	\$600	\$0	\$0	\$600
<b>Subcontractor – Neset</b>	\$3,952,123	\$4,321,092	\$540,136	\$8,813,351
<b>Subcontractor – Paragon</b>	\$103,723	\$829,782	\$103,723	\$1,037,228
<b>Subcontractor – SLB</b>	\$100,000	\$0	\$0	\$100,000
<b>Subcontractor – Stress Engineering</b>	\$60,000	\$0	\$0	\$60,000
<b>Subcontractor – Loudon Technical Services</b>	\$8000	\$0	\$0	\$8,000
<b>Communications</b>	\$60	\$0	\$0	\$60
<b>Printing &amp; Duplicating</b>	\$980	\$0	\$0	\$980
<b>Laboratory Fees &amp; Services</b>				
Document Production Service	\$9285	\$0	\$0	\$9285
Software Solution Services	\$3910	\$0	\$0	\$3910
Technical Software Fee	\$3777	\$0	\$0	\$3777
Field Safety Fee	\$45,711	\$0	\$0	\$45,711
Geoscience Services Fee	\$3387	\$0	\$0	\$3387
Outside Lab – MVTL	\$10,110	\$0	\$0	\$10,110
<b>Total Direct Costs</b>	<b>\$4,818,183</b>	<b>\$5,150,874</b>	<b>\$643,859</b>	<b>\$10,612,916</b>
<b>Facilities &amp; Administration</b>	\$332,691	\$0	\$0	\$332,691
<b>Total Project Costs</b>	<b>\$5,150,874</b>	<b>\$5,150,874</b>	<b>\$643,859</b>	<b>\$10,945,607</b>

**TAX LIABILITY**

The EERC, a department within the University of North Dakota, is a state-controlled institution of higher education and is not a taxable entity; therefore, it has no tax liability.

**CONFIDENTIAL INFORMATION**

This proposal does not contain confidential information.

**REFERENCES**

Stanislawski, J.J.; Folkedahl, B.C.; Jensen, M.D.; Musich, M.A. *Regional Impacts of Carbon Capture and Sequestration in the State of North Dakota*; Final Report for Lignite Energy Council; EERC Publication 2019-EERC-02-07; Energy & Environmental Research Center: Grand Forks, ND, Feb 2019.

**APPENDIX A**

**LETTERS OF SUPPORT**

September 25, 2024

Ms. Amanda Livers-Douglas  
Assistant Director for Integrated Subsurface Projects  
University of North Dakota  
Energy & Environmental Research Center  
15 North 23rd Street, Stop 9018  
Grand Forks, ND 58202-9018

Dear Ms. Livers-Douglas:

Subject: EERC Proposal No. 2025-0049 Entitled "Coal Creek Carbon Capture Geologic CO<sub>2</sub> Storage Complex Development Add-On"

I am writing to confirm Rainbow Energy Center's commitment to support the Energy & Environmental Research Center (EERC) in its pursuit of funding from the Lignite Research, Development and Marketing Program (LRDMP) to complete site characterization and permitting for the geologic storage of CO<sub>2</sub> captured as part of commercial-scale CO<sub>2</sub> storage in central North Dakota.

The vision for this carbon capture and storage (CCS) project is to equip Coal Creek Station with a full-scale postcombustion CO<sub>2</sub> capture system that will capture up to 10 million tonnes per year of CO<sub>2</sub>, approximately 95% of CO<sub>2</sub> emissions, at Coal Creek Station, located between Washburn and Underwood, North Dakota. When Rainbow Energy Center resolves the financial and technical challenges associated with the commercial deployment of an integrated CCS project, the captured CO<sub>2</sub> will be committed to the geologic storage sites being addressed in the proposed effort unless a portion of the CO<sub>2</sub> can be marketed for CO<sub>2</sub> enhanced oil recovery.

Rainbow Energy Center and its partners represent the largest landowner and pore space owner in the proposed project area. As part of its support and commitment, Rainbow Energy Center will support appropriate field site access to Rainbow Energy Center-owned land to facilitate the work described in the application, should funding for the proposed project be awarded.

To demonstrate our support and commitment, should LRDMP and U.S Department of Energy (DOE) funding for the proposed project be awarded, Rainbow Energy Center will fund an additional \$643,859 for a total of \$ 5,354,784 in cash cost share. This will be provided with no limitations, restrictions, or contingencies.

We welcome the opportunity to partner with the EERC, Neset Consulting Services, DOE, and LRDMP to establish an integrated CCS project in North Dakota: a project that will ensure wise, future development of our state's abundant coal resource and optimization of pore space. If you have any questions, please contact me by telephone or by email.

Sincerely,



Jeffrey Jonson  
President

# NESET

6844 Highway 40, Tioga, ND 58852 701-664-1492

April 13, 2023

Ms. Amanda Livers-Douglas  
Assistant Director for Integrated Subsurface Projects  
University of North Dakota  
Energy & Environmental Research Center  
15 North 23rd Street, Stop 9018  
Grand Forks, ND 58202-9018

Dear Ms. Livers-Douglas:

Subject: EERC Proposal No. 2023-0147 Entitled "Coal Creek Carbon Capture: Geologic CO<sub>2</sub> Storage Complex Development

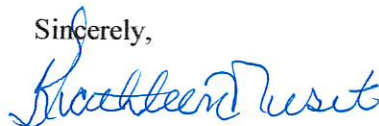
I am writing in support of the Energy & Environmental Research Center's (EERC's) pursuit of carbon capture and storage (CCS) at Coal Creek Station.

Neset Consulting Services, an officially certified Woman-Owned Business and Woman-Owned Small Business, has successfully operated in the Willison Basin from its headquarters in Tioga, ND, for over 40 years, contributing to the successful completion of 7700+ wells. We have worked in collaboration with the EERC to serve as a drilling contractor for multiple UIC (underground injection control) Class VI-compliant appraisal wells to support geologic storage on anthropogenic CO<sub>2</sub>. We are committed to providing the staff and resources necessary to support outreach and the drilling, characterization, logging, coring, testing and completion of appraisal well(s) as outlined in the subject proposal.

We welcome the opportunity to partner with the EERC, Rainbow Energy Center, the U.S. Department of Energy, and Lignite Research, Development and Marketing Program to establish an integrated CCS project in North Dakota: a project that will ensure wise, future development of our nation's abundant energy resources. If you would like to discuss, please contact me by telephone or by email.

I look forward to working with you and hope to see this project move forward in North Dakota.

Sincerely,



Kathleen Neset  
President, Owner



November 7, 2022

Ms. Amanda Livers-Douglas  
Assistant Director for Integrated Subsurface Projects  
University of North Dakota  
Energy & Environmental Research Center  
15 North 23rd Street, Stop 9018  
Grand Forks, ND 58202-9018

Re: CarbonSAFE Site Characterization and Permitting for Commercial-Scale Geologic  
Carbon Storage in Central North Dakota (DE-FOA-0002711)

Dear Ms. Livers-Douglas:

The North American Coal Corporation, a NACCO company, is committed to support the Energy & Environmental Research Center (EERC) in its response to the subject U.S. Department of Energy (DOE) funding opportunity to complete site characterization and permitting for the geologic storage of CO<sub>2</sub> captured as part of Rainbow Energy Center's emerging commercial-scale CO<sub>2</sub> storage project in central North Dakota.

North American Coal represents one of the largest landowners with pore space ownership within the proposed project area. As part of its support and commitment, North American Coal will support appropriate field site access to North American Coal-owned land to facilitate the work described in the application, should funding for the proposed project be awarded. North American Coal is interested in the potential opportunity to lease pore space for CO<sub>2</sub> storage at this site.

We welcome this opportunity to partner with the EERC, Neset Consulting Service, Rainbow Energy Center, DOE, and the rest of the team pursuing opportunities to resolve challenges associated with the commercial deployment of an integrated carbon capture and storage project in North Dakota. If successful, it will help ensure wise future development of our state's abundant natural resources. If you have any questions, please contact me by telephone or by email.

Sincerely,

A handwritten signature in blue ink, appearing to read 'D Straley', is written over a horizontal line.

David Straley  
Director, External Affairs

NACCO Natural Resources Land Department

2000 Schafer Street, Suite D  
Bismarck, ND 58501-1204

701.258.2200

[nacco.com](http://nacco.com)





## **APPENDIX B**

### **QUALIFICATIONS OF KEY PERSONNEL**



**AMANDA J. LIVERS-DOUGLAS**

Assistant Director for Integrated Subsurface Projects  
Energy & Environmental Research Center (EERC), University of North Dakota (UND)  
15 North 23rd Street, Stop 9018, Grand Forks, North Dakota 58202-9018 USA  
701.777.5344, alivers@undeerc.org

***Education and Training***

M.S., Geology, University of Kansas, 2016.

B.A., Physics, Concordia College, Moorhead, Minnesota, 2013.

Geophysics experience includes seismic reflection, seismic refraction tomography, side-scatter analysis, multichannel analysis of surface waves, backscatter analysis of surface waves, diffraction imaging, and ground-penetrating radar diffraction tomography.

Software experience includes HampsonRussell, Petrel, Vista, Omni, Kingdom, GeoTomo Geothrust and Vecon, RadExPro TomoSeis, MASW/SurfSeis, SeisUtilities, and MatLab.

***Research and Professional Experience***

**2022–Present:** Assistant Director for Integrated Subsurface Projects, EERC, UND.

- Leads team of geoscientists focused on subsurface investigations of both conventional and unconventional resources, CO<sub>2</sub> storage, enhanced oil recovery, water disposal, and produced gas storage.
- Provides oversight for development of reservoir models including interpretation and integration of geophysical data for hydrocarbon resource assessment and geologic CO<sub>2</sub> storage analyses.
- Serves as carbon capture and storage (CCS) project advisor for geologic site characterization, monitoring, regulatory compliance, and North Dakota underground injection control (UIC) Class VI permitting.
- Has served as project manager for project development and permitting phase of several commercial carbon CCS projects.
- Has overseen development of geologic exhibits for five UIC Class VI permits submitted to state of North Dakota and served as expert witness at hearings for these permits, testifying to suitability of storage zone for safe and permanent storage of CO<sub>2</sub>.

Principal areas of interest and expertise include characterization and monitoring of subsurface by developing innovative processing methods and designing specialized data acquisition surveys.

**2020–2022:** Principal Geoscientist, EERC, UND.

- Supervised interdisciplinary team of researchers focused on understanding deep subsurface geology.
- Provided oversight for development of reservoir models including interpretation and integration of geophysical data for hydrocarbon resource assessment and geologic CO<sub>2</sub> storage analyses.

**March 2016–2019:** Senior Research Geophysicist, EERC, UND.

- Developed geophysical models of subsurface.
- Performed advanced interpretation on variety of geophysical datasets.
- Performed petrophysical analyses of geophysical data.
- Assisted in preparation of technical reports.

- Interfaced with diverse team of scientists and engineers to assess project uncertainties in oil and gas development and geologic CO<sub>2</sub> storage.

**August 2013–March 2016:** Exploration Division Research Assistant, Kansas Geological Survey (KGS), Lawrence, Kansas, Missouri.

- Developed new seismic processing methods for void detection.
- Processed seismic data using near-surface processing methods, including refraction tomography, multichannel analysis of surface waves, backscatter analysis of surface waves, diffraction imaging, and side-scatter analysis.
- Generated near-surface models to accompany professional reports for clients that contracted KGS services.
- Interpreted preliminary results using generated 2D and 2.5D models, downhole data, and log data.
- Worked on team to produce professional site assessment reports for clients.
- Tested in-house software, reporting encountered errors, and suggesting changes to streamline user interfaces.
- Designed field surveys and led field crews in seismic data collection.

**May–August 2015:** Geoscience Intern, Chesapeake Energy Corporate Headquarters, Oklahoma City, Oklahoma.

- Interpreted and correlated well logs for the Powder River Basin, Wyoming, using GeoGraphix.
- Tied well log data to 3D seismic data and picked formation horizons using SMT Kingdom.
- Analyzed relationship between seismic attribute trends and historic drilling activity, including completion and production data using SMT Kingdom and Spotfire.
- Compiled information on basin's geologic history, petroleum system, and current drilling activity.
- Presented geophysical interpretations and overview of basin to engineering and geosciences business units.

**January 2011–May 2013:** Paleontology Field Investigator and Laboratory Technician, Concordia College, Moorhead, Minnesota.

- Developed and implemented electronic cataloging system to update 1500 bone entries.
- Investigated Hell Creek Formation outcrops in eastern Montana for possible bone sites by walking the outcrops.
- Recorded possible site location coordinates and transferred GPS (global positioning system) coordinates and field notes into electronic maps.
- Quarried, cast, and transported bones from the field, and cleaned and restored bones in the lab.

**May–August 2012:** Incorporated Research Institutions for Seismology Intern, Virginia Polytechnic Institute and State University, Blacksburg, Virginia.

- Completed 7-day training at New Mexico Tech, Socorro, New Mexico, comprising seismology short courses and field training at the Program for Array Seismic Studies of Continental Lithosphere's (PASSCAL) instrument center; surveyed seismic station locations, and deployed seismometers throughout Idaho and Oregon for an IDOR (EarthScope Idaho–Oregon) large-scale active seismic survey.
- Processed 2D land data from the Salton Seismic Imaging Project using refraction tomography.
- Created 2D tomography models, and interpreted subsurface structural geology.
- Presented results during poster session at American Geophysical Fall Meeting.

**Spring 2010–Spring 2012:** Student Assistant, Department of Physics, Concordia College, Moorhead, Minnesota.

- Served as department tutor, teaching assistant, and lab technician.

**May–August 2011:** North Dakota Geological Survey Student Worker, Wilson M. Laird Core and Sample Library, Grand Forks, North Dakota.

- Compiled reports on 37 EarthScope Transportable Array Stations in North Dakota containing information about station locations, instrumentation, and data collection, and generated standard geologic maps for each station.

***Publications***

Has coauthored several professional publications.



**KEVIN C. CONNORS**

Assistant Director for Regulatory Compliance and Energy Policy  
Energy & Environmental Research Center (EERC), University of North Dakota (UND)  
15 North 23rd Street, Stop 9018, Grand Forks, North Dakota 58202-9018 USA  
701.777.5236, kconnors@undeerc.org

***Education and Training***

B.S., Geology, University of Montana, 2009.

***Research and Professional Experience***

**November 2021–Present:** Assistant Director for Regulatory Compliance and Energy Policy, EERC, UND.

- Works with a multidisciplinary team of scientists, engineers, and business professionals to integrate legal and regulatory policy, permitting, economics, and tax perspectives with applied research related to incremental oil recovery, unconventional oil recovery, and CO<sub>2</sub> capture and geologic storage.
- Manages the Plains CO<sub>2</sub> Reduction (PCOR) Partnership focused on commercial deployment of carbon capture, utilization, and storage (CCUS).

Principal areas of interest and expertise include regulatory policy, permitting, and regulatory interpretation related to the geologic storage of CO<sub>2</sub>, enhanced oil recovery, and unconventional oil and gas development.

**July 2019–October 2021:** Principal Policy and Regulatory Strategist, EERC, UND.

- Worked with a multidisciplinary team of scientists, engineers, and business professionals to integrate legal and regulatory policy, economics, and tax perspectives with applied research related to incremental oil recovery, unconventional oil recovery, and CO<sub>2</sub> capture and geologic storage.

**November 2018–June 2019:** Principal Consultant Drilling and Well Operations, Equinor Energy, Austin, Texas.

- Worked as a regulatory advisor for Equinor’s Williston Basin Bakken asset.
- Gained experience in securing federal and state permits to drill, advising Equinor stakeholders on regulatory issues, and maintaining compliance in a multijurisdictional regulatory environment.
- Worked on special projects with Equinor’s research and technology teams as the lead regulatory advisor in developing solutions to gas flaring and CO<sub>2</sub> emissions in the Bakken.

**October 2010–October 2018:** North Dakota Industrial Commission (NDIC) Oil and Gas Division.

October 2015–October 2018: Pipeline Program Supervisor.

- Position was created by the North Dakota Legislature to develop North Dakota’s first Underground Gathering Pipeline Program to improve pipeline integrity.
- Development of the pipeline program included administrative rule making, hiring and managing office and field staff, developing a data management system (database), and meeting with industry leaders and academic researchers.

- Created guidance documents for program staff, regulatory inspectors, and the regulated community; testified before the North Dakota Legislature; and presented at public events throughout western North Dakota.

July 2011–October 2018: CCS Supervisor.

- Position was created by the North Dakota Legislature to provide a timely response to the U.S. Environmental Protection Agency (EPA) rules relating to the geologic sequestration of CO<sub>2</sub> (Class VI).
- Successfully led North Dakota’s efforts to obtain Class VI primacy for the state of North Dakota.
- Gained expertise in the EPA Underground Injection Control (UIC) Program and North Dakota’s geologic storage of CO<sub>2</sub> statutes and authored and adopted North Dakota’s CO<sub>2</sub> storage rules through the administrative rule-making process.
- Participated in the North Dakota Carbon Dioxide Storage Workgroup, testified before the North Dakota Administrative Rules Committee, authored publications, and presented at technical conferences on carbon capture and storage regulatory frameworks.
- Has expertise in North Dakota’s pore space amalgamation process for CO<sub>2</sub> storage and gas storage.
- In 2018, developed guidelines for gas storage in North Dakota. The guidance document was intended to provide a pathway forward for permitting and storing Bakken produced gas to mitigate flaring.

October 2013–October 2015: UIC Supervisor.

- Administered the North Dakota Class II UIC Program.
- Issued over 100 UIC permits, revised and updated program technical guidelines, evaluated regulatory filings, performed technical evaluations of UIC permit applications, and processed well completion reports, workover reports, and various other regulatory filings.
- Prepared and submitted quarterly reports to EPA as part of the UIC program primacy agreement between North Dakota and EPA.
- In spring 2015, created a regulatory comparison table using North Dakota statutes and regulations in comparison to the Bureau of Land Management (BLM) proposed rules on hydraulic fracturing. The regulatory comparison was key evidence in the state of North Dakota’s lawsuit against BLM.

October 2010–July 2011: Petroleum Engineer.

- As an oil and gas inspector, conducted enforcement and compliance inspections in the field during a time of increasing oil and gas activity.

**January–September 2010:** Wellsite Geologist, Weatherford.

- Provided geological services for the drilling and completion of horizontal wells in the Bakken and Three Forks Formations.

### ***Awards and Honors***

2022 Governor’s Award for Excellence in Public Service, for state team members who go above and beyond to serve North Dakotans and deliver on the shared purpose to Empower People, Improve Lives, and Inspire Success.

2022 Distinguished Service Award – Research & Development Program, Lignite Energy Council, for dedication and service to the Lignite Energy Council and the lignite industry in North Dakota.

### ***Publications***

Has authored and coauthored numerous professional publications.



**JAMES A. SORENSEN**

Director of Subsurface Research and Development  
Energy & Environmental Research Center (EERC), University of North Dakota (UND)  
15 North 23rd Street, Stop 9018, Grand Forks, North Dakota 58202-9018 USA  
701.777.5287, jsorensen@undeerc.org

***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.  
Responsible for developing and managing programs and projects focused on conventional, unconventional, and enhanced oil and gas production; the geological storage of CO<sub>2</sub>; and other energy and environmental research. Primary areas of interest and expertise are enhanced oil recovery (EOR) in unconventional tight oil formations, CO<sub>2</sub> utilization and storage in geologic formations, and tight oil resource assessment and development.

**July 2018–September 2019:** Assistant Director for Subsurface Strategies, EERC, UND.  
Developed business opportunities, provided technical support and guidance regarding emerging areas of research, and served as a principal investigator (PI) and task manager for projects related to the sequestration of CO<sub>2</sub> in geologic media and the sustainable development of tight oil resources.

**1999–July 2018:** Principal Geologist, EERC, UND.  
Served as manager and co-PI for programs to develop strategies for CO<sub>2</sub> utilization and storage. Led research focused on EOR in the Bakken.

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

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

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

***Professional Activities***

Member, Society of Petroleum Engineers

***Publications***

Has coauthored nearly 200 publications.



**JOHN A. HAMLING**

Assistant Vice President for Strategic Partnerships  
Energy & Environmental Research Center (EERC), University of North Dakota (UND)  
15 North 23rd Street, Stop 9018, Grand Forks, North Dakota 58202-9018 USA  
701.777.5472, jhamling@undeerc.org

***Principal Areas of Expertise***

Hamling has over 20 years of experience in the energy industry catalyzing and implementing pioneering solutions that facilitate the prudent development and use of low-carbon and fossil energy. Hamling has broadly developed and strengthened strategic business relationships and has grown an energy-focused research and development (R&D) portfolios at state, national, and global levels.

Hamling serves as a development lead and advisor for screening, risk assessment, characterization, qualification, design, permitting, incentive program compliance, installation, and monitoring aspects of multiple geologic CO<sub>2</sub> storage projects ranging from 1000 to over 18,000,000 tonnes per year, including several currently operating underground injection control (UIC) Class VI storage projects in the United States. Hamling also serves as an advisor and development lead for several enhanced oil recovery (EOR) pilots in both conventional and unconventional fields; produced water treatment demonstration and use projects; high-value mineral resource assessment and recovery projects; and commercial development projects focused on direct air capture and low-carbon hydrogen production, storage, and use.

Hamling has led efforts resulting in the development, proof of concept, and validation of several improved monitoring techniques applicable to both dedicated and associated geologic CO<sub>2</sub> storage and EOR applications. Hamling's experience extends to the design, implementation, and oversight of surface, near-surface, deep subsurface, and reservoir characterization and surveillance programs.

Hamling's experience includes well-logging principals and applications, well drilling, well completions, wellbore integrity, risk assessment, logistics, well stimulation and enhanced recovery in tight oil plays, and health, safety, and environmental (HSE) programs. Hamling has lead the formation and management of a policy and regulatory team focused on carbon capture and storage (CCS), gas storage, improved oil recovery (IOR)/EOR, and unconventional oil and gas development with extensive experience conducting risk assessments and developing monitoring, mitigation, and verification/monitoring, reporting, and verification (MRV) programs compliant with the California Air Resources Board Low Carbon Fuel Standard CCS Protocol, MRV plan provisions of the U.S. Environmental Protection Agency (EPA) greenhouse gas reporting rule Subpart RR compliant with the Internal Revenue Service (IRS) 45Q tax credit program, EPA UIC Class II and Class VI programs, state/provincial regulatory programs, and emerging carbon markets/incentive programs.

Hamling has served as project manager (PM), principal investigator (PI), and task lead for several multiyear, multimillion-dollar research and demonstration projects and has led data analytics, operations, and reservoir surveillance groups at the EERC alongside several adaptive, multidisciplinary project teams. These activities encompass both contract research and several strategic partnership programs among the state of North Dakota, the U.S. Department of Energy (DOE), and private industry



designed to propel the development and implementation of approaches that benefit practical energy development.

***Education and Training***

M.S. Petroleum Engineering, University of North Dakota, 2022.

B.S., Mechanical Engineering, University of North Dakota, 2007.

Associate of Science, Associate of Arts, Williston State College, 2004.

Certified Engineer in Training (EIT)

***Research and Professional Experience***

**May 2022–Present:** Assistant Vice President for Strategic Partnerships, EERC, UND. Hamling broadly develops relationships to advance technologies and concepts that enable commercial application of CCS, unconventional oil and gas production, and IOR in conventional and unconventional oil plays.

**May 2021–Present:** Assistant Vice President for CCUS, EERC Foundation. Hamling has actively played a key role in standing up and growing a national and international portfolio of commercial research service capabilities focused on carbon capture, utilization, and storage (CCUS) within the EERC Foundation.

**May 2021–May 2022:** Director of Subsurface Initiative, EERC, UND. Broadly developed and strengthened strategic business relationships and subsurface R&D portfolios at state, national, and global levels. Led multidisciplinary teams of scientists and engineers and played a lead role in working with industry partners to stand up several individual CCUS projects that exceeded \$10 billion of commercial investment when fully implemented. Served as PM/PI/task lead for multiyear, multimillion-dollar, DOE-sponsored state research programs focused on carbon management and geologic storage. Hamling also led the design, implementation, and operation of an active reservoir management demonstration and brine treatment technology testbed facility.

**2018–April 2021:** Assistant Director of Integrated Projects, EERC, UND. In this role, Hamling advanced innovation and technologies to enable commercial application of geologic carbon storage, unconventional oil and gas production, and IOR in both conventional and unconventional oil plays.

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

**2012–2018:** Principal Engineer, Oilfield Operations Group Lead, EERC, UND. Hamling served as PM, PI, and task lead for several multiyear, multimillion-dollar projects, leading a multidisciplinary team of scientists and engineers working to develop and implement MVA concepts for large-scale (>1 million tons per year) CO<sub>2</sub> storage and EOR operations. Hamling also worked with a multidisciplinary team in the development, design, and implementation of new approaches that benefit the economical exploration, development, and production of oil and gas.

**2011–2012:** Research Manager, EERC, UND. Hamling's responsibilities included managing characterization and monitoring research activities and operations for large-scale (>1 million tons per year) combined EOR and CO<sub>2</sub> storage projects for the Plains CO<sub>2</sub> Reduction (PCOR) Partnership. Hamling also led various research activities related to oil and gas production, infrastructure, and development from unconventional reservoirs.

**2009–2011:** Research Engineer, EERC, UND. Hamling focused on the design and implementation of new approaches that benefit the exploration, development, and production of oil and gas and with the PCOR Partnership, evaluating the potential for CO<sub>2</sub> storage in geologic formations. Specific responsibilities included field operations design, deployment, and interpretation relating to oilfield technologies applicable to the CCS industry; laboratory functions relating to the Applied Geology Laboratory (AGL); data analysis; regulatory compliance; and communication of operations between service providers, management teams, industry partners, and governmental organizations. Additional responsibilities included investigation and/or demonstration of techniques and/or technologies that can enhance oil and gas production or economically benefit the oil and gas industry while reducing the environmental footprint of drilling and production operations.

**2007–2009:** Reservoir Evaluation Engineer; HSE Representative; and Loss Prevention Team Leader, Reservoir Evaluation segment, Schlumberger Limited. Hamling was responsible for providing tailored geophysical solutions for specific and unique oilfield applications, executing basic and advanced reservoir evaluations utilizing real-time wellbore measurement technologies, reservoir pressure and fluid sampling, and interpretation of reservoir measurement data. In this role, Hamling designed and oversaw all aspects of openhole and cased-hole logging operations for over 300 wells in both conventional and unconventional oil and gas plays and also served as an HSE officer, loss prevention team lead, and explosives and radiation safety officer for wellsite activities.

**2004–2007:** Student Research Scientist/Engineer, EERC, UND. Hamling was responsible for conducting research related to the development of new methods to join high-temperature, creep-resistant alloys and advanced processing and manufacture techniques for silicon carbide ceramic composites; materials testing in accordance with ASME (American Society of Mechanical Engineers), ASTM International, and ISO (International Organization for Standardization) standards; analyzing scanning electron microscopy micrographs; designing and fabricating composite micrometeorite shielding; and literature and patent review.

### ***Professional Activities***

Society of Petroleum Engineers International Williston Basin Section – have continuously served as a section officer and board member since 2012. Positions include Acting Chairperson, Vice-Chairperson, and Communications Chairperson.

Served as PCOR Partnership representative on the writing committee for two U.S. Department of Energy Regional Carbon Sequestration Partnership (RCSP) Program BPMs entitled *Best Practices for Monitoring, Verification, and Accounting of CO<sub>2</sub> Stored in Deep Geologic Formations – Version 3* and *Best Practices for Operating Carbon Storage Projects*.

### ***Publications***

Hamling has authored and coauthored numerous technical publications.

# NESET

**RESUME:**

**KATHLEEN NESET**

Updated: November 28, 2022

**ADDRESS:**

6844 Highway 40  
Tioga, North Dakota 58852  
kathleenneset@nesetconsulting.com  
Telephone: 701-664-1492 office  
701-664-1491 fax  
701-641-0004 cell

**PROFESSIONAL:**

ND Petroleum Council Board of Directors, Executive Committee  
North Dakota Petroleum Council: Past Chair  
ND Clean Sustainable Energy Authority  
ND Early Childhood Transition Committee  
UND College of Engineering and Mines Executive Board  
UND Petroleum Engineering Industry Advisory Committee  
Theodore Roosevelt Medora Foundation Board of Directors  
Diocese of Bismarck Catholic Foundation Board of Directors  
API Williston, Dickinson, Minot ND Chapters: Member  
AAPG: Member  
North Dakota Geological Society  
Federal Reserve Bank of Minneapolis: Past Director  
North Dakota State Board of Higher Education: Past Chair  
ND 2020 & Beyond: Co-chair

**EDUCATION:**

December 2021	H2S Safety Training
September 2018	Shell Energy Executive Program, Roberts, Louisiana
April 2011	Hess Home Safe
April 2009	Core Workshop, Regina, Saskatchewan
March 2009	H <sub>2</sub> S Respirator Fit Test
April 2008	Complex Well Workshop, Minot, North Dakota
May 2002	Horizontal Technology for Geologists, Short Course, Mauer Technology Inc. Bismarck, ND.
May 2001	Nisku Core Workshop, Regina, Saskatchewan
May 1984	Well Control School, Prentice Training, Lafayette, LA.
June 1978	B.A. Brown University, Providence, Rhode Island. Geology major with emphasis in mathematics.
June 1974	Warren Hills Regional High School, Washington, New Jersey.

**AWARDS & CERTIFICATES:**

- 2022: Woman Business Enterprise National Council certification
- 2022: Woman Owned Small Business
- 2022: Woman Business Enterprise
- 2014: Williston API Individual Outstanding Achievement winner
- 2014: Top 25 Leading Women in Business
- 2014: Ambassador Award - Williston Regional Economic Development Corporation
- 2015: Williston API Lifetime Achievement Award
- 2015: North Dakota Petroleum Council Hall of Fame
- 2015: Leading Ladies Panelist
- 2017 University of Mary Virtuous Leadership Award
- 2018 Inspired Woman Award

**GENERAL EXPERIENCE:**

March 1980 to present:

President, Neset Consulting Service, manage wellsite geology, engineering, and mudlogging consulting business. From 1980 through 2006 Roy and Kathleen started, managed, and lead Neset Consulting Service as we provided geological and engineering services to the oil industry, primarily in the Northern Rockies. From 2006 to present Kathleen has served as president of the company with a new branding to NESET in 2018. This rebranding represented the continual reinventing of the company to meet the diverse needs of the ever changing oil and gas industry. Recently the focus has built out and embraced carbon capture and management for the industry. NESET has been involved both geologically and with overall operational management of multiple carbon sequestration projects in ND. Work has also included the development of wind technician training for the wind industry, and NESET has broadened engineering providing all engineering, surveying, wellsite supervision, and well design and management.

March 1980 to Sept 2006:

Wellsite geologist, Tioga, ND: through wellsite work in the Rocky Mountains, I have acquired techniques for the complete evaluation of both wildcat and development wells. My experience in horizontal drilling has kept me current in the newest trends of oil and gas exploration, including the targeting of remote bottomhole locations in highly deviated wellbores and multi-laterals. Recent work has given me horizontal experience in the Ordovician Montoya formation of the Permian Basin, West Texas.

August 1990 to January 1992:

Temporary Business Manager, Tioga Public Schools, Tioga, ND.

November 1985 to May 1986:

Science Teacher, Tioga High School, Tioga, ND.

February 1979 to March 1980:

Hydrocarbon well logger, Core Laboratories, Casper, Wyoming: provided me with invaluable wellsite knowledge and experience. Through logging I have seen firsthand the geology of East Texas, the Powder River Basin, Green River Basin, and the Williston Basin. I have also gained wellsite experience in east Texas, and seismic experience in Michigan.

**Randy Neset**

Phone: 701-641-0778

E-mail: <mailto:randyneset@nesetconsulting.com>

Current Residence: Tioga ND

Neset Consulting Employment History

**Vice President of Engineering**

- ◇ General drilling contractor for large CCUS project western North Dakota
- ◇ General drilling contractor for over 12 saltwater disposal wells
- ◇ Design drilling and completion programs for horizontal Bakken and Three Forks and SWD wells
- ◇ Manage 150 field personnel including drilling, completion, and production supervisors, safety supervisors, midstream operators, lease operators, OGI technicians, and well techs
- ◇ Successfully work with NDIC as lead contractor to plug and abandon wells with CARES Act Funds
- ◇ Establish strategic partnerships with industry service companies to provide first in class services to clients
- ◇ Develop vendor management and accounts payable procedures for NDIC P&A program, CCUS programs, and EERC wells
- ◇ Train mudloggers and lease operators on oil and gas operations
- ◇ Assist in managing over 300 mudloggers operating on over a peak of 112 drilling rigs

**Experience:**

**SHD Oil & Gas, LLC – Tioga ND**

**Dates Employed: 2010 – 2021**

**Chief Operating Officer**

- ◇ Assist raising over \$350 million around project
- ◇ HBP over 37,000 acres
- ◇ Increase production from 0 – 10,000 bopd
- ◇ Direct all field operations including drilling, completions, and production
- ◇ Solicit bids and hire contractors for interim wellsite reclamation
- ◇ Work with surveyors for scouting, staking, and permitting in accordance with BIA, BLM, TERO, and State of North Dakota regulations
- ◇ Solicit bids and hire contractors for wellsite construction
- ◇ Field development design utilizing multi-well pads
- ◇ Develop drilling plan - hire all contractors for drilling operations
- ◇ Reservoir engineering - volumetrics to calculate OOIP
- ◇ Manage daily production and operations
- ◇ Provide technical support to lease operators
- ◇ Design production facilities
- ◇ Design rod and tubing strings, downhole pumps, pumping units
- ◇ Supervise workover rig - SRL installation and workovers

**RC Disposal, LLC – Tioga ND**

**Dates Employed: 2011 – 2014**

**President**

Responsibilities included raising \$7.5 million to drill and complete 2 x SWD wells, permitting salt water disposal well through NDIC, generating AFE salt water disposal well, designing wellbore and surface

facilities, hiring service contractors to perform work, overseeing drilling and completion of well, and managing day to day operations. The company was successfully sold for \$20 million.

**Hess Corporation – Tioga ND  
Lift Tech**

**Dates Employed: 2009 - 2010 Artificial**

Responsibilities included providing technical support to Lease Operators, analyzing dynamometer cards for downhole pump performance, designing rod and tubing strings, downhole pumps, pumping units, writing workover procedures and cost estimates, designing treatment programs for scale, corrosion, and paraffin and training – Roustabout, Lease Operator, Workover Rig Manager.

**Helmerich and Payne – Dickinson ND  
Roughneck**

**Dates Employed: 2008**

Responsibilities included serving as a floorhand, performing rig up, rig down operations, making up BHA and drill pipe, teaching new rig hands the floorhand responsibilities and general rig maintenance.

**Eagle Well Service – Kenmare ND  
Righand**

**Dates Employed: 2007**

Responsibilities included serving as a floorhand, operating tubing and rod tongs, operating rig while swabbing during well completions and teaching new rig hands the floorhand responsibilities

**Montana Air National Guard – Great Falls MT  
Intelligence Analyst**

**Dates Employed: 2002 - 2010**

Responsibilities included providing timely threat analysis to F-16 pilots, providing current intelligence to Wing Commander, keeping Intelligence library updated with newly released material, supervising airmen appointed to me, ensuring on the job training is adequate for younger airmen and completing Pacific AEF tour in South Korea and Operation Iraqi Freedom Tour – 6 months at Balad AB, Iraq. Received an Air Force Achievement Award.

**Larry's Service – Tioga ND  
Mechanic Assistant**

**Dates Employed: 1999 - 2002**

Responsibilities included installation of new tires on vehicles and ensure customer's vehicle is safe to drive, changing oil and service customer's vehicle to shop standards, serving as an associate with customers to ensure their vehicle is serviced the way they would like, helping lead mechanic install engines, transmissions, axles, transfer cases and service all of these items and test driving vehicles to ensure mechanical problems are fixed.

**Neset Farms – Tioga ND  
Heavy equipment operator/laborer**

**Dates Employed: 1999 - 2002**

Responsibilities included operation of farm machinery, maintenance of Neset Farms grain elevator, calibration of seeder, sprayer, and combine for optimal efficiency and maintaining records of labor time, fuel used, hourly use of equipment, items purchased and regular farm supplies

**Skills & Education:**

Graduated high school from Tioga ND in 2002

Montana Tech – Bachelors of Science in Petroleum Engineering, graduated in May 2009

- |                        |                              |
|------------------------|------------------------------|
| ◇ Microsoft Word       | ◇ Adobe                      |
| ◇ Microsoft Excel      | ◇ Well Control Certified     |
| ◇ Microsoft Powerpoint | ◇ WellPro                    |
| ◇ WellView             | ◇ H <sub>2</sub> S Certified |
| ◇ WellEZ               | ◇ 10 HR OSHA                 |

**Jessica K. Bell**

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• belljessicak@gmail.com

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<b>OBJECTIVE</b>	To continue my endeavor to positively impact individuals and promote the energy industry by utilizing my experience in environmental and tax policy, business development and government relations.
<b>EXPERIENCE</b>	<p><b>Rainbow Energy Center; August 2022-Current</b> <i>Director, Government &amp; Public Affairs</i></p> <ul style="list-style-type: none"><li>• Execute project development opportunities</li><li>• Evaluate best practices for carbon capture utilization and storage technologies</li><li>• Coordinate research efforts with the EERC</li><li>• Enhance environmental, social and governance practices</li><li>• Monitor and evaluate Federal and State regulations as they pertain to independent power producers</li><li>• Interact with regional transmission operators to ensure power deliverability</li></ul> <p><b>NACCO Natural Resources; May 2004-Current</b> <i>Environmental Manager of Northern Operations (2020-2022)</i></p> <ul style="list-style-type: none"><li>• Oversee and manage all environmental matters for northern operations</li><li>• Evaluate best practices for carbon management, including carbon capture utilization and storage technologies, soil carbon storage and other opportunities</li><li>• Evaluate and improve environmental, social and governance compliance</li><li>• Monitor and evaluate Federal environmental regulations impacting operations and articulate the position of NACCO Natural Resources for Federal Register Notice filings</li></ul> <p><b>Coyote Creek Mining Company</b> <i>Environmental Manager (2017-2020)</i></p> <ul style="list-style-type: none"><li>• Primarily responsible for all environmental duties at the mine site including securing all permits for operation at local, state and federal level, air quality, wildlife management, cultural resources management, waste management and short and long-term budgeting and department management</li><li>• Active participant in the Lignite Energy Council trade organization</li><li>• Completed life of mine Individual Permit from the Department of the Army Corps of Engineers</li><li>• Initiated application to mine Federal coal with the Department of the Interior</li></ul> <p><b>The Coteau Properties Company Freedom Mine</b> <i>Environmental Specialist (2007-2017); Tour Guide (2006-2007); Environmental Assistant (2004-2005)</i></p> <ul style="list-style-type: none"><li>• Manage over 15,000 acres of mined and reclaimed farm land alongside local producers</li><li>• Repeatedly proved mined and reclaimed farm land is more successful than before mining and released thousands of acres of productive land from company liability and bonds</li><li>• Write and update all environmental sections of mining permits</li><li>• Supervisory experience of both employees and contractors</li><li>• Initiated environmental baseline studies for first new coal mine in 30 years in ND</li></ul> <p><b>North Dakota State Senate; Nov 2012-Nov 2022</b> <i>District 33 Senator &amp; Citizen Legislator</i></p>

# CONWAY NELSON, P. Eng, PMP

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[conwaynelson@gmail.com](mailto:conwaynelson@gmail.com)

Engineering and Project Management professional with over 25 years of experience. Highly developed skills in engineering design, project management, people management, team building, leadership, communication, relationship development.

## EXPERIENCE

November 2023 – present

### Director, Carbon Management

*Rainbow Energy Center, Bismarck, ND (remote from Regina, SK)*

- Leading the development of an 8.5M tonne per year carbon capture and storage project for a 1200 MW coal fired power station.
- Overseeing execution of a \$47M NETL CarbonSafe grant to characterize geologic sequestration in the area local to the power station.
- Overseeing completion of a \$16M FEED study to finalize the scope and cost for the retrofit of carbon capture equipment to the power station and a subsequent Bridge Study to work towards a final investment decision.

May 2021 – October 2023

### Vice President, Project Development & Technical Services,

*International Carbon Capture & Storage Knowledge Centre, Regina, SK*

- Led a team of engineers and chemists that provide high level process design and technical advice related to planning and execution of carbon capture projects across various industries (power generation, cement, oil and gas, refineries, etc.).
- Responsible for business development activities and grew the PD&TS team from five to twelve staff in two years.
- Presented at various industry conferences and webinars about Carbon Capture lessons learned and the work of the Knowledge Centre.
- Oversaw technical consulting services executed for carbon capture projects across a variety of industries.

June 2019 – May 2021

### Manager, Power Production Project Delivery Office, SaskPower, Regina, SK

- Lead a team of 19 project managers and project control specialists to deliver the power production sustainment portfolio of projects (\$130m annual budget) as well as new generation projects that are managed by SaskPower (Chinook Power Station, Great Plains Power Station)
- Provide guidance and mentorship to Project Managers across Power Production to ensure effective project delivery.
- Emphasize continuous improvement by defining and optimizing our Project Management processes, developing, measuring and displaying KPI's while continuing to foster strong relationships with our engineering, construction and operations team members



## EXPERIENCE (cont.)

May 2018 – June 2019

**Lead, Project Lifecycle Optimization Initiative, SaskPower, Regina, SK**

- Led a corporate optimization initiative to examine how projects are managed across SaskPower and make recommendations to improve performance. Performed internal and external research and worked with the SaskPower executive to achieve alignment regarding the practice of project management.  
SaskPower established a corporate project management office based on my team's recommendations and have been working towards increasing project management maturity

May 2018 – June 2019

**Lead, Project Lifecycle Optimization Initiative, SaskPower, Regina, SK**

- Led a corporate optimization initiative to examine how projects are managed across SaskPower and make recommendations to improve performance. Performed internal and external research and worked with the SaskPower executive to achieve alignment regarding the practice of project management.  
SaskPower established a corporate project management office based on my team's recommendations and have been working towards increasing project management maturity

April 2016 – May 2018

**Manager, Power Production Project Delivery Office, SaskPower, Regina, SK**

- Managed a team of 15 project managers and project control specialists to deliver the power production sustainment portfolio of projects (\$130m annual budget) as well as new generation projects that are managed by SaskPower (Chinook Power Station - \$680m budget).
- Worked closely with the Transmission business unit PDO to share best practices.

November 2013 – April 2016

**Manager, Clean Energy, SaskPower, Regina, SK**

- Led a team responsible for evaluating the feasibility of clean energy technologies primarily nuclear and solar power.

August 2008 – November 2013

**Manager, Mechanical Engineering, SaskPower, Regina, SK**

- Led a team of engineers and contracted resourced to manage projects and provide mechanical engineering services to execute the power production capital plan.

March 2006 – August 2008

**Project Leader, SaskPower, Regina, SK**

- Managed the refurbishment of a 300 Megawatt boiler and various projects related to emissions reduction technology for coal-fired power plants.

April 2003 – March 2006

**Mechanical Engineer II, SaskPower, Regina, SK**

- Performed engineering design and managed capital sustainment projects of increased complexity and magnitude for power generation plants.

## EXPERIENCE (cont.)

March 2000 – April 2003

**Mechanical Engineer I**, *SaskPower, Regina, SK*

- Performed engineering design and managed capital sustainment projects for power generation plants.

January 1998 – March 2000

**Project Engineer**, *BAR Engineering, Lloydminster, AB*

- Design and project engineering work for various oil and gas clients.

## PROFESSIONAL AFFILIATIONS

**Professional Engineer** *Association of Professional Engineers & Geoscientists of Saskatchewan*

**Permission to Consult** *Association of Professional Engineers & Geoscientists of Saskatchewan*

**Project Management Professional** *Project Management Institute*

## EDUCATION

December 1997

**B. Sc. in Mechanical Engineering**, *University of Saskatchewan*

## SKILLS

- Engineering
- Business Development
- Relationship Building
- Project Management
- Corporate Improvement
- Contract Management and Negotiation
- Communication
- Corporate Strategy
- People Management
- Leadership
- Coaching

## ACTIVITIES & INTERESTS

- Travelling and spending time with my family
- Cycling, competing in triathlons, running races and adventure races
- Parent volunteer for youth hockey, triathlon, karate and speed skating

## REFERENCES

Available upon request



**JOHN A. BRUNNER**

Senior Research Engineer

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

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

(701) 777-5059, jbrunner@undeerc.org

***Education and Training***

B.S., Mechanical Engineering, University of North Dakota, 2019.

Software experience includes Microsoft Office Suite, PTC Creo, Visio, Autodesk, MATLAB, GT Suite, and Solidworks.

Fabrication experience includes pipe/tube bending and cutting and MIG and SMAW welding.

***Research and Professional Experience***

**February 2024–Present:** Senior Research, EERC, UND

**May 2019–February 2024:** Research Engineer, EERC, UND.

- Contributes to the design, modeling, and fabrication of experimental equipment, including oversight and operation.
- Assists in preparation of proposals, interprets data, writes reports and papers, and presents results to clients and papers at national and international conferences.

Principal areas of interest and expertise include design and modeling of experimental equipment, gasification and combustion technologies, energy storage systems, and renewable energy technologies.

**April 2018–April 2019:** Research Engineering Assistant, EERC, UND.

- Worked on the design and modeling of flue gas exhaust.
- Assisted in modeling of a carbon dioxide capture system.
- Modeled a portable baghouse.
- Led a project to integrate virtual reality into the engineering design process.

**February 2016–April 2018:** Facilities and Safety Assistant, EERC, UND.

- Conducted scheduled safety inspections.
- Assisted in the hazard communication program.
- Calibrated and maintained safety equipment.

**Summers 2015–2017:** Laboratory Intern, RMB Environmental Laboratories, Detroit Lakes, Minnesota.

- Conducted nitrate and nitrite testing.
- Assisted in total phosphorus, ortho-phosphorus, biological oxygen demand, chemical biological oxygen demand, bacteria, and solids testing.

***Publications***

Has coauthored several publications.



**DR. CHANTSALMAA DALKHAA**

Principal Reservoir Engineer, Reservoir Engineering Team  
Energy & Environmental Research Center (EERC), University of North Dakota (UND)  
15 North 23rd Street, Stop 9018, Grand Forks, North Dakota 58202-9018 USA  
701.777.5448, dalkhaa@undeerc.org

***Education and Training***

Ph.D., Petroleum and Natural Gas Engineering, Middle East Technical University (METU), Ankara, Turkey, 2010.

M.S., Petroleum and Natural Gas Engineering, METU, Ankara, Turkey, 2005.

B.S., Petroleum and Natural Gas Engineering, METU, Ankara, Turkey, 2003.

Proficient in the use of Petrel (geologic modeling), Eclipse (fluid flow reservoir simulation), CMG IMEX/STARS/GEM/CMOST, TOUGH2/TOUGHREACT, ArcGIS/Arcmap, and IHS Harmony/DeclinePLUS/RTA/Petra.

***Research and Professional Experience***

**February 2020–Present:** Principal Reservoir Engineer, EERC, UND.

- Coleads Reservoir Engineering team, supervising reservoir engineers and geoscientists, managing and overseeing projects, contributing to research proposal writing and preparation, and conducting technical and research work.

Principal areas of interest and expertise include numerical modeling and simulation of various EOR techniques including rich gas, CO<sub>2</sub> and surfactant, CO<sub>2</sub> storage and monitoring, unconventional production evaluation, and Class VI permit applications.

**June 2019–January 2020:** Senior Reservoir Engineer, EERC, UND.

- Supervised junior reservoir engineers and student research assistants and worked with reservoir engineers, geologists, and geophysicists to develop and calibrate geologic models of the subsurface and run dynamic simulations to evaluate CO<sub>2</sub> EOR performance of oil fields and the long-term fate of CO<sub>2</sub> sequestration into saline aquifers, evaluate production performance of unconventional oil and gas reservoirs, and assess refracturing potential in the Bakken petroleum system.

**2016–May 2019:** Reservoir Engineer, Reservoir Modeling and Simulation, EERC, UND.

- Worked with teams of reservoir engineers, geologists, and geophysicists to develop and calibrate geologic models of the subsurface and run dynamic simulations to evaluate CO<sub>2</sub> EOR performance of oil fields and the long-term fate of CO<sub>2</sub> sequestration into saline aquifers, estimate ultimate oil recovery, and evaluate production performance of unconventional oil reservoirs.

**2014–2015:** Postdoctoral Fellow, Department of Chemical and Petroleum Engineering, University of Calgary, Calgary, Alberta, Canada.

- Constructed a geologic model of heavy Canadian oil fields using Petrel.
- Simulated a wormhole formation and growth in CHOPS reservoir and performed history matching of reservoir fluid and sand productions.
- Assessed reservoir performance of thermal, solvent, and hybrid EOR methods using CMG STARS.

**2011–2014:** Postdoctoral Fellow, Department of Geoscience, University of Calgary, Calgary, Alberta, Canada.

- Stimulated microbial activities in a CHOPS reservoir in the Lloydminster area, Canada, to enhance oil recovery for a project funded by Natural Sciences and Engineering Research Council of Canada and Husky Oil Operation Ltd.
- Performed reactive transport simulation of CO<sub>2</sub> injection into a reservoir and CO<sub>2</sub> leakage to shallower formations for the Quest Project, funded by Shell Canada.
- Applied stable isotopic techniques in monitoring of injected CO<sub>2</sub> for the Quest Project and Swan Hills and PennWest CO<sub>2</sub> pilot projects.
- Simulated CO<sub>2</sub> injection into a H<sub>2</sub>S-containing aquifer located in central Alberta for a project funded by Carbon Management Canada.
- Performed oilfield fluid sampling and analysis at various fields (Pembina Cardium CO<sub>2</sub> EOR pilot, Swan Hills CO<sub>2</sub> EOR fields in the Western Canadian Sedimentary Basin).
- Performed laboratory work on CO<sub>2</sub> reactivity and microbial EOR in CHOPS reservoirs.

**2006–2011:** Research and Teaching Assistant, Department of Petroleum & Natural Gas Engineering, METU, Ankara, Turkey.

- Performed reservoir simulation of immiscible CO<sub>2</sub> and water alternating gas injection into a heavy oil field in Europe in southeastern Turkey using Eclipse/Petrel.
- Mentored and guided senior year students for graduation projects and coordination of courses.
- Evaluated coalbed methane production capacity from the Soma coal bed in Turkey.

### ***Professional Activities***

Member, Association of Professional Engineers and Geoscientists of Alberta – Engineer in Training (2011–present)

Member, Society of Petroleum Engineers (2003–present)

Member, European Association of Geoscientists and Engineers (2010)

Member, The Geochemical Society (2012)

Technical Reviewer, *Journal of CO<sub>2</sub> Utilization* (2019–present), *International Journal of Greenhouse Gas Control* (2017–present), and *Greenhouse Gases: Science and Technology* (2017–present)

Postdoctoral Representative, Faculty of Science, University of Calgary (2012–2013)

General volunteer, MentorUp Calgary (2014)

General volunteer, APEGA (2014)

Member, EERC Social Cause Committee (2016–present)

### ***Publications***

Has coauthored several professional publications.



**JOHN P. KAY**

Principal Engineer, Emissions and Carbon Capture  
Energy & Environmental Research Center (EERC), University of North Dakota (UND)  
15 North 23rd Street, Stop 9018, Grand Forks, North Dakota 58202-9018 USA  
701.777.4580, jkay@undeerc.org

***Education and Training***

B.S., Geological Engineering, University of North Dakota, 1994.  
Associate Degree, Engineering Studies, Minot State University, 1989.

***Research and Professional Experience***

**2011–Present:** Principal Engineer, Emissions and Carbon Capture, EERC, UND.

- Responsibilities include management of CO<sub>2</sub> separation research related to bench-, pilot-, and demonstration-scale equipment for advancement of technology as well as development of cleanup systems to remove SO<sub>x</sub>, NO<sub>x</sub>, particulate, and trace elements to render flue gas clean enough for separation.
- Principal areas of interest and expertise include applications of solvents for removing CO<sub>2</sub> from gas streams to advance technology and look toward transformational concepts and techno-economic assessments.
- Experience includes 12 years of field testing site management and sampling techniques for hazardous air pollutants and mercury control in combustion systems along with 10 years of experience utilizing scanning electron microscopy (SEM), x-ray diffraction (XRD), and x-ray fluorescence (XRF) techniques to analyze coal, fly ash, biomass, ceramics, and high-temperature specialty alloys.
- Other interests include computer modeling systems and high-temperature testing systems.

**2005–2011:** Research Manager, EERC, UND.

- Responsibilities included management and supervision of research involving design and operation of bench-, pilot-, and demonstration-scale equipment for development of clean coal technologies.
- Work also involved testing and development of fuel conversion (combustion and gasification) and gas cleanup systems for removal of sulfur, nitrogen, particulate, and trace elements.

**1994–2005:** Research Specialist, EERC, UND.

- Responsibilities included conducting SEM, XRD, and XRF analysis and maintenance; creating innovative techniques for analysis and interpretation of coal, fly ash, biomass, ceramics, alloys, high-temperature specialty alloys, and biological tissue; managing day-to-day operations of Natural Materials Analytical Research Laboratory; supervising student workers; developing and performing infrared analysis methods in high-temperature environments; and performing fieldwork related to mercury control in combustion systems.

**1993–1994:** Research Technician, Agvise Laboratories, Northwood, North Dakota.

- Responsibilities included receiving and processing frozen soil samples for laboratory testing of chemical penetration, maintaining equipment and inventory, and training others in processing techniques utilizing proper laboratory procedures.

**1991–1993:** Teaching Assistant, Department of Geology and Geological Engineering, UND.

- Responsibilities included teaching Introduction to Geology Recitation, Introduction to Geology Laboratory, and Structural Geology; preparation and grading of assignments; and administering and grading class examinations.

**1990–1992:** Research Assistant, Natural Materials Analytical Laboratory, EERC, UND.

- Responsibilities included operating x-ray diffractometer and interpreting and manipulating XRD data, performing software manipulation for analysis of XRD data, performing maintenance and repair of XRD machine and sample carbon coating machine, preparing samples for XRD and SEM analysis, and performing point count analysis on SEM.

***Professional Activities***

Member, ASM International

Member, American Ceramic Society

Member, Microscopy Society of America

***Publications***

Has authored or coauthored numerous publications.



**KATHERINE K. ANAGNOST**

Senior Regulatory and Permitting Specialist  
Energy & Environmental Research Center (EERC), University of North Dakota (UND)  
15 North 23rd Street, Stop 9018, Grand Forks, North Dakota 58202-9018 USA  
701.777.5437, kanagnost@undeerc.org

***Education and Training***

B.S., Legal Assistance, Moorhead State University, 1992.

***Research and Professional Experience***

**2021–Present:** Senior Regulatory and Permitting Specialist, EERC, UND.

- Works with a multidisciplinary team of scientists, engineers, and business professionals to integrate permitting, regulatory, legal, policy, economics, and tax perspectives with technical information and applied research related to geologic CO<sub>2</sub> capture, utilization, and storage (CCUS); power generation; emissions reduction; and renewable energy systems.
- Currently supports the Plains CO<sub>2</sub> Reduction (PCOR) Partnership Initiative to Accelerate CCUS Deployment as the technology transfer task lead, informing and educating stakeholders about CCUS technologies and project development, with particular emphasis placed on issues related to infrastructure development strategies and regulatory frameworks.
- Supports public and industry outreach efforts through development of products and website content to inform and educate about the opportunities associated with CCUS.

Principal areas of interest and expertise include regulatory compliance; geologic CCUS; power generation; emissions reduction; and renewable energy systems. Additional experience includes the areas of fossil-fuel-based generation and transmission, legal analysis and writing, and technical research experience toward successful energy strategy permit development.

**2015–2021:** NERC Compliance Coordinator, Minnkota Power Cooperative (MPC), Grand Forks, North Dakota.

- Coordinated with technical and support teams to establish, maintain, and demonstrate compliance with corporate requirements and North American Electric Reliability Corporation (NERC) regulations.
- Spearheaded the effort to bring comprehensive Critical Infrastructure Program regulatory compliance to the Milton R. Young Generating Station within the scheduled implementation time frame
- Coordinated a multidisciplinary team in the development of a new Critical Infrastructure Program regulatory supply chain risk management program within the required implementation time frame.
- Achieved expedited industry consensus to regulatory modifications as participating member (and first MPC employee) on a NERC Standard Drafting Team, and served (as the first MPC employee) on a North American Transmission Forum peer review team.

**2009–2015:** Research Specialist/Project Manager, EERC, UND.

- Worked for the PCOR Partnership, one of seven regional partnerships funded by the U.S. Department of Energy's National Energy Technology Laboratory Regional Carbon Sequestration Partnership Program, to assess the technical and economic feasibility of capturing and storing (sequestering) CO<sub>2</sub>



emissions in the northern Great Plains and adjacent areas. In this capacity, facilitated the development of project plans for research data, presentations, technical reports, peer-reviewed articles, and proposals for projects involving CO<sub>2</sub> sequestration technologies.

- Work also included development, management, and dissemination of market-oriented materials for programs focused on CO<sub>2</sub> sequestration, including public outreach and education via print, video, and web forums.

**2006–2009:** Contracts Officer, EERC, UND.

- Prepared, reviewed, negotiated, and administered sponsored research agreements, in-kind agreements, subcontracts, hotel agreements, and confidentiality agreements in accordance with federal and nonfederal contractual requirements, government and university regulations and policies, and EERC policies.
- Disclosed intellectual property (IP) to research sponsors, including government agencies.
- Tracked important contractual and U.S. Patent and Trademark Office compliance dates associated with IP.
- Effectively communicated and maintained daily contact with research sponsors, agency representatives, UND employees, and EERC employees via telephone, email, and/or letter.

**1994–2006:** Legal Assistant, MPC.

- Assisted legal counsel in the representation of MPC and six distribution cooperative member-owners, including drafting corporate governance documents; assisting with environmental matters including compliance with polychlorinated biphenyl use, storage, disposal, and recordkeeping; and preparing and submitting federal environmental reports for proposed cooperative construction activities.
- Coordinated with engineering consultant and technical department supervisors on the preparation and organization of Spill Prevention Control and Countermeasures (SPCC) Plans.
- Reviewed federal regulations and determined potential impacts and/or ensured compliance.
- Wrote articles for corporate publications.
- Led Minnesota member-owner utilities' compliance with the Conservation Improvement Program, created to provide improved awareness and adoption of energy-efficient technologies and reduced energy costs for Minnesota households. In this role, worked with regional Community Action Agencies on development of energy conservation measures benefiting low-income households.

***Publications***

Has authored or coauthored several publications.



**JOHN S. OLESIK**

Senior Engineer

Energy & Environmental Research Center (EERC), University of North Dakota (UND)  
15 North 23rd Street, Stop 9018, Grand Forks, North Dakota 58202-9018 USA  
701.777.5027, jsoleksik@undeerc.org

***Education and Training***

B.S., Petroleum Engineering, University of North Dakota, 2016.

B.A., Economics, University of North Dakota, 2016.

***Research and Professional Experience***

**May 2021– Present:** Senior Engineer, Advanced Energy Systems, EERC, UND.

**April 2019–April 2021:** Research Engineer, Advanced Energy Systems, EERC, UND.

- Contributes to design, modeling, and fabrication of experimental equipment.
- Oversees and operates equipment.
- Interprets data.
- Assists in preparing proposals, reports, and papers.
- Presents project results to clients and at national and international conferences.

Principal areas of interest and expertise include energy and chemical conversion, pre- and postcombustion carbon capture and utilization, emission control and impurities removal, upstream petroleum production facilities, and economic assessment.

**October 2018–April 2019:** Research Engineer (temporary), EERC, UND.

- Served as floor engineer for operation of pilot-scale coal gasification system.
- Assisted in planning and execution of equipment and system assembly.
- Prepared, moved, and assembled pilot-scale components for testing.
- Performed in-field troubleshooting for malfunctioning system components.

**May 2017–Present:** Partner, JOLS Contractors LLP, Williston, North Dakota.

- Partnered with other general contractors in residential roofing, remodeling, and repair business. Planned and designed projects to meet customer needs.
- Coordinated with other contractors to schedule work and complete projects on time and on budget.
- Performed bidding, expensing, and billing.

**January–April 2017:** Associate Field Technology Specialist, Halliburton, Williston, North Dakota.

- Performed testing on water, sand, and fracture fluid samples to ensure quality of work.
- Maintained and tracked pressure, chemical concentrations, sand concentrations, and fluid downhole rate to assist fracture crew in delivering fracture to customer design specifications.

**August 2015–May 2016:** Managing Director of Marketing, Dakota Venture Group.

- Worked toward new recruiting strategy for developing talent within Dakota Venture Group.
- Maintained communication between investors, alumni, advisory board, and group members.
- Released updates, newsletters, quarterly updates, and promotional material.
- Executed four due diligence reports, one of which serving as team lead.

**Summer 2015:** Drilling Engineer Intern, Marathon Oil Corporation, Williston, North Dakota.

**Summer 2014:** Floorhand, Nabors Drilling USA, Williston, North Dakota.

**Summers 2012 and 2013:** Warehouse Supervisor, Total Service Supply, Williston, North Dakota.

***Professional Activities***

Member, Society of Petroleum Engineers

***Publications***

Has coauthored several publications.



**CAITLIN M. OLSEN**

Principal Policy and Regulatory Strategist  
Energy & Environmental Research Center (EERC), University of North Dakota (UND)  
15 North 23rd Street, Stop 9018, Grand Forks, North Dakota 58202-9018 USA  
701.777.5399, colsen@undeerc.org

***Education and Training***

B.S., Geology with a Hydrogeology minor, University of Wisconsin – River Falls, 2013.

***Research and Professional Experience***

**January 2024–Present:** Principal Policy and Regulatory Strategist, EERC, UND.

- Works with project teams and EERC clients to inform strategies and implement solutions that enable prudent production and use of fossil energy and reduce the carbon intensity of energy production.
- Develops, communicates, and informs sound regulation, policy, guidelines, standards development, and technical and business strategies.
- Works with a multidisciplinary team of scientists, engineers, and business professionals to integrate permitting, regulatory, legal, policy, economics, and tax perspectives with technical information and applied research related to incremental oil recovery; unconventional oil recovery; geologic CO<sub>2</sub> capture, utilization, and storage (CCUS); power generation; emissions reduction; and renewable energy systems.

Principal areas of interest and expertise include regulatory compliance, geologic CCUS, power generation, emissions reduction, and renewable energy systems. Experience also includes project management, data analysis, staff supervision and development, and safety audits.

**February 2022–January 2024:** Senior Regulatory and Permitting Specialist, EERC, UND.

- Worked with a multidisciplinary team of scientists, engineers, and business professionals to integrate permitting, regulatory, legal, policy, economics, and tax perspectives with technical information and applied research related to incremental oil recovery, unconventional oil recovery, geologic CCUS, power generation, emissions reduction, and renewable energy systems.

**August 2021–January 2022:** Assistant Compliance Manager, Mayo Clinic, Rochester, Minnesota.

- Created and managed compliance assurance program for the Facilities Management Division at Mayo Clinic.
- Served as project manager for developing and implementing lockout tagout program for southeast Minnesota health systems hospitals and clinics.
- Developed and implemented confined-space protocols for southeast Minnesota hospitals and clinics.
- Maintained currency in assigned compliance areas including Joint Commission, Occupational Safety and Health Administration, and U.S. Environmental Protection Agency (EPA).

**June 2018–July 2021:** Production and Measurement Supervisor, North Dakota Industrial Commission (NDIC) Oil and Gas Division, Bismarck, North Dakota.

- Supervised work of production, auditing, and measurement department, which includes team of field inspectors, production assistants, and temporary office workers.

- Coordinated and reviewed production reporting processes, measurement processes, and measurement reporting processes that support regulatory functions of NDIC.
- Led Production and Measurement team on various production-tracking and metering projects, including working with web developers to build new reporting database.
- Managed oil-conditioning and gas capture compliance projects within state of North Dakota.
- Analyzed statistical data to predict and summarize future gas capture changes.
- Conducted and coordinated response to industry and public inquiries related to production reporting and oil and gas measurement-related field activities, providing responses in timely manner.
- Maintained relationships with gas midstream providers and provided strong communication lines with executive personnel.
- Reviewed surface commingling applications, tracked and input meter information, reviewed proving reports, and tracked natural gas liquid units.
- Conducted yearly appraisals, organized workflow, monitored employee productivity, hired and trained new employees, and performed other supervisory duties.
- Developed, researched, and delivered orders of Commission, including gas capture and oil-conditioning policies, resulting in statewide changes to oil and gas production protocol.

**November 2013–June 2018:** Petroleum Engineer–Field Inspector, NDIC Oil and Gas Division, Williston, North Dakota.

- Conducted physical compliance inspections of drilling exploration and oil production sites, which included permitted locations, drill rigs, production and injection wells, and associated facilities.
- Ensured permitting compliance for drilling rigs.
- Compiled information on geologic zones penetrated, drillstem tests run, cores cut, and directional surveys.
- Inspected well completions, recompletions, workovers, plugged wellsites, and pipelines to monitor and evaluate progress of reclamation.
- Approved openhole-plugging procedures and witnessed plugging of wells to ensure proper isolation of oil and water reservoirs.
- Oversaw remediation of spills in wetlands, sloughs, grassland, and cropland and monitored requirements of environmental and reclamation concerns.
- Investigated and responded to public complaints and operator inquiries.
- Ensured compliance guidelines were met by working with EPA, Bureau of Land Management, and Forest Service.
- Generated diverse range of presentations including oil-conditioning policies, gas capture recommendations, electromagnetic and electrical resistivity tomography surveying, microseismic monitoring, and magnetic ranging capabilities.

**May–August 2012:** Environmental Inspector, Regulatory Department, City of Minneapolis, Minneapolis, Minnesota.

- Inspected and conducted routine field investigations to resolve environmental problems such as noise, air quality, water quality, and soil pollution.
- Coordinated and prepared reports, research efforts, and mapping projects related to environmental projects and issues.
- Drafted and issued permits and ensured compliance through inspections.
- Reviewed and recommended permit denials, revocations, or administrative fines.
- Responded to private and public agencies for emergency response and reporting of emergency incidents and provided assistance to city as required.

- Represented Health Department in public meetings, public relations, media relations, and communications with elected officials and other stakeholders.



**DR. JOHN A. TEMPLETON**

Senior Geoscientist

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***Education and Training***

Ph.D., Geology, Columbia University, 2015.

M.Div., Wake Forest University, 2004.

B.S., Geology and Chemistry, University of North Carolina, Chapel Hill, 2001.

***Research and Professional Experience***

**2021–Present:** Senior Geoscientist, EERC, UND.

- Interfaces with diverse team of scientists and engineers to assess project uncertainties in oil and gas development and geologic CO<sub>2</sub> storage, including developing geophysical models of subsurface and performing regional geological characterization.
- Helps lead diversity, equity, inclusion, and accessibility efforts at EERC.

Principal areas of interest and expertise include structural geology, tectonics, sedimentology and stratigraphy, geophysical interpretation, and exploration geology.

**2017–2021:** Senior Geologist, Lower 48 New Ventures, ConocoPhillips.

- Served as lead structural geologist for exploration team focusing on Lower 48 opportunities in Gulf Coast and Rocky Mountain basins.

**2016:** Senior Geologist, Permian Basin Development Team, ConocoPhillips.

- Served as lead geologist for San Andres and Holt redevelopment on Central Basin Platform focused on carbonate sequence stratigraphy and quantitative seismic stratigraphy.

**2015:** Geologist, Global New Ventures, ConocoPhillips.

- Led Southeast Asia regional project including Myanmar, Cambodia, and Vietnam.

**2014:** Intern, Subsurface Technology Clastic Stratigraphy Group, ConocoPhillips.

- Work focused on quantitative seismic stratigraphic interpretation of deepwater turbidite channel reservoirs in Choctaw Basin, Gulf of Mexico.

**2013:** Intern, Sedimentology Research Group, Statoil, Norway.

- Work focused on sediment provenance of Triassic and Jurassic rift basins, North Sea, using detrital zircon thermochronology.

**2011–2014:** Teaching Assistant, Columbia University.

- Served as Graduate Teaching Assistant for Plate Tectonics, Advanced General Geology, Death Valley field course, and Introduction to the Solid Earth.

**2008–2009:** Assistant Teacher, Candler Elementary School, Candler, North Carolina.

- Assisted with reading and math for second and fifth grade classrooms.

**2008–2009:** Interim Campus Minister, United Methodist Wesley Foundation, University of North Carolina, Asheville.

**2006–2007:** Youth and Children’s Minister, First Baptist Church, Spruce Pine, North Carolina.

**2005–2006:** Associate Campus Minister, Mars Hill College, Mars Hill, North Carolina.

***Publications***

Has authored and coauthored several professional publications.





**DR. AGUSTINUS ZANDY**

Principal Operations Specialist

Energy & Environmental Research Center (EERC), University of North Dakota (UND)  
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***Education and Training***

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

M.S., Petroleum Engineering, University of North Dakota, 2017.

Bachelor's degree, Chemical Engineering, Bandung Institute of Technology, Indonesia, 2007.

***Research and Professional Experience***

**October 2022–Present:** Principal Operations Specialist, EERC, UND.

- Works with project teams and EERC clients and leads efforts related to carbon capture, utilization, and storage (CCUS) projects; well drilling and completion designs; field activities related to drilling, logging, coring, and completion; well production/injection performance; and well injection (step rate, extended, and fall-off tests) and stress tests interpretation.
- Mentors junior team members.
- Works with team members to prepare proposals.
- Develops and manages projects, personnel, and budgets.
- Prepares and manages the preparation of technical reports.
- Delivers technical presentations.
- Works with potential clients and service companies.
- Prepares and organizes technical documents related to drilling and injection permitting for Class I, II, and VI wells and storage facility permits.

Principal areas of interest and expertise include drilling and completion design (Class I, Class II, and Class VI wells); production optimization and simulation; artificial lift design (gas lift and electric submersible pump); and drilling, logging, coring, well-testing, and production operations.

**August 2020–September 2022:** Senior Operations Specialist, EERC, UND.

- Worked with project teams and EERC clients to perform drilling and completion design.
- Conducted field activities related to drilling, logging, coring, and completion.
- Analyzed artificial lift designs (gas lift and electric submersible pump).
- Evaluated well production/injection performance.
- Mentored junior team members.
- Worked with team members to prepare proposals.
- Developed and managed projects, personnel, and budgets.
- Prepared and managed preparation of technical reports.
- Delivered technical presentations, working with team members, clients, and potential clients.
- Prepared and organized technical documents related to drilling and injection permitting for Class I, II, and VI wells.

**2017–July 2020:** Oilfield Operations Specialist, EERC, UND.

- Led efforts related to design and execution of oil and gas field activities such as well drilling, logging, downhole fluid sampling, coring, and well completion and analyzing hydraulic fracturing practices to look for optimization methods.
- Worked with team members to prepare proposals.
- Developed and managed projects, personnel, and budgets.
- Prepared and managed preparation of technical reports and delivered technical presentations, working with team members, clients, and potential clients.
- Prepared and organized technical documents related to drilling and injection permitting for Class I, II, and VI wells.

**2016–2017:** Research Assistant (part-time), EERC, UND.

- Worked at EERC while completing M.S. degree, where activities included initiating completion design for CO<sub>2</sub> sequestration and brine inject wells for CO<sub>2</sub> plume optimization projects and gathering and organizing technical documents related to drilling and injection permitting for Class I, II, and VI wells.

**2015–2016:** Senior Petroleum Engineer, Tiabumi Petroleum, Jakarta, Indonesia.

- Accelerated well production by 50% by conducting well service and ESP frequency adjustment.
- Designed well completion (including artificial lift selection and well type) for three development wells.
- Yielded 30% piping cost reduction by proposing multifunctional dual-pipe system.
- Advanced production facility processes up to 99% by converting batching to continuous system, modifying piping system and fluid flow at no cost.

**2010–2015:** Petroleum Engineer, Medco E&P Indonesia, Jakarta, Indonesia.

- Developed waterflood pattern optimization by identifying fluid flow direction and connectivity in formation.
- Introduced interference test as methodology to identify flow unit connectivity in Baturaja Formation, and analyzed test results using Ecrin.
- Formulated best well completion design using WellFlo, which includes completion type, tubing size, artificial lift selection and installation schedule, perforation method, and specification and stimulation type, with various scenarios related to reservoir performance forecasting.
- Executed multistage acidizing operation using coiled-tubing unit in limestone reservoir with reservoir contact of 2500 ft MD and total acid treatment volume of 1800 bbl, substantially increasing oil production.
- Stimulated well production by selecting optimum artificial lift, redesigning existing artificial lift (gas lift and ESP), and stimulating reservoir.
- Pioneered monobore system for marginal gas field well that reduced drilling capital expenditures with no gas rate reduction.
- Introduced sand control selection methodology for unconsolidated reservoir to minimize wellbore damage during production.

**2007–2010:** Asset Production Engineer, Medco E&P Indonesia.

- Established production and water injection network model using WellFlo and ReO that successfully increased total water injection rate by 20% and improved piping system to reduce pipe operating pressure by 5–10 psig.

- Implemented ESP–gas lift hybrid system that was successful in minimizing production loss by 30% during ESP system failure and installed with no failures.
- Coordinated slickline operations such as pressure–temperature downhole survey, resetting gas lift valve, and inside mandrel (IM-Pack OFF) installation for gas lift deepening and tubing clearance, including electronic memory gauge programming and data receiving.
- Initiated intermittent gas lift installation in low-production wells, which successfully increased production by 50% from 12 wells.
- Established water injection well stimulation schedule using rigless operation that effectively maintained voidage replacement ratio (VRR) >1.0.

***Professional Activities***

Member, Society of Petroleum Engineers

***Publications***

Has coauthored several professional publications.

**APPENDIX C**  
**BUDGET NOTES**

## BUDGET JUSTIFICATION

### ENERGY & ENVIRONMENTAL RESEARCH CENTER (EERC)

#### BACKGROUND

The Energy & Environmental Research Center (EERC) is an independently organized multidisciplinary research center within the University of North Dakota (UND). The EERC is funded through federal and nonfederal grants, contracts, and other agreements. Although the EERC is not affiliated with any one academic department, university faculty may participate in a project, depending on the scope of work and expertise required to perform the project.

#### INTELLECTUAL PROPERTY

The applicable federal intellectual property (IP) regulations will govern any resulting research agreement(s). In the event that IP with the potential to generate revenue to which the EERC is entitled is developed under this project, such IP, including rights, title, interest, and obligations, may be transferred to the EERC Foundation, a separate legal entity.

#### BUDGET INFORMATION

The proposed work will be done on a cost-reimbursable basis. The distribution of costs among budget categories (labor, travel, supplies, equipment, etc.) and among funding sources of the same scope of work is for planning purposes only. The project manager may incur and allocate allowable project costs among the funding sources for this scope of work in accordance with Office of Management and Budget (OMB) Uniform Guidance 2 Code of Federal Regulations (CFR) 200.

Escalation of labor and EERC recharge center rates is incorporated into the budget when a project's duration extends beyond the university's current fiscal year (July 1 – June 30). Escalation is calculated by prorating an average annual increase over the anticipated life of the project.

The cost of this project is based on a specific start date indicated at the top of the EERC budget. Any delay in the start of this project may result in a budget increase. Budget category descriptions presented below are for informational purposes; some categories may not appear in the budget.

**Salaries:** Salary estimates are based on the scope of work and prior experience on projects of similar scope. The labor rate used for specifically identified personnel is the current hourly rate for that individual. The labor category rate is the average rate of a personnel group with similar job descriptions. Salary costs incurred are based on direct hourly effort on the project. Faculty who work on this project may be paid an amount over the normal base salary, creating an overload that is subject to limitation in accordance with university policy. As noted in the UND EERC Cost Accounting Standards Board Disclosure Statement, administrative salary and support costs which can be specifically identified to the project are direct-charged and not charged as facilities and administrative (F&A) costs. Costs for general support services such as contracts and IP, accounting, human resources, procurement, and clerical support of these functions are charged as F&A costs.

**Fringe Benefits:** Fringe benefits consist of two components, which are budgeted as a percentage of direct labor. The first component is a fixed percentage approved annually by the UND cognizant audit agency, the Department of Health and Human Services. This portion of the rate covers vacation, holiday, and sick leave (VSL) and is applied to direct labor for permanent staff eligible for VSL benefits. Only the

actual approved rate will be charged to the project. The second component is estimated on the basis of historical data and is charged as actual expenses for items such as health, life, and unemployment insurance; social security; worker's compensation; and UND retirement contributions.

**Travel:** Travel may include site visits, fieldwork, meetings, and conferences. Travel costs are estimated and paid in accordance with OMB Uniform Guidance 2 CFR 200, Section 474; and UND travel policies, which can be found at <https://campus.und.edu/finance/procurement-and-payment-services/travel/travel.html> (Policies & Procedures, A–Z Policy Index, Travel). Daily meal rates are based on U.S. General Services Administration rates unless further limited by UND travel policies; other estimates such as airfare, lodging, ground transportation, and miscellaneous costs are based on a combination of historical costs and current market prices. Miscellaneous travel costs may include parking fees, Internet charges, long-distance phone, copies, faxes, shipping, and postage.

**Supplies:** Supplies include items and materials that are necessary for the research project and can be directly identified to the project. Supply and material estimates are based on prior experience with similar projects. Examples of supply items are chemicals, gases, glassware, nuts, bolts, piping, data storage, paper, memory, software, toner cartridges, maps, sample containers, minor equipment (value less than \$5000), signage, safety items, subscriptions, books, and reference materials. General-purpose office supplies (pencils, pens, paper clips, staples, Post-it notes, etc.) are included in the F&A cost.

**Subcontract – Neset Consulting Service (Neset):** Neset will generate authorization for expenditure (AFE) for the stratigraphic test well and be hired as a general drilling contractor to select, contract, and manage third parties for the drilling and injection test operations. The cost (\$8,813,351) is based on an updated AFE for the stratigraphic test well coring (\$5,401,364) and a quote for the injection test (\$3,411,987).

**Subcontract – Paragon Geophysical Services, Inc. (Paragon):** Paragon will acquire 3D seismic data for the project area. The cost (\$1,037,228) is based on an updated AFE.

**Subcontract – SLB:** SLB will design the injection test, interpret the data, and generate a report. The cost (\$100,000) is based on historical expenses from previous efforts with similar scope.

**Subcontract – Stress Engineering Services Inc. (Stress Engineering):** Stress Engineering will conduct evaluation of materials compatibility testing and perform corrosion modeling to determine and generate a demonstration of materials compatibility for Class VI permitting. The cost (\$60,000) is based on historical expenses from previous efforts with similar scope.

**Subcontract – Loudon Technical Services:** Loudon Technical Services will provide advisement and oversight on the materials compatibility evaluation and modeling. The cost (\$8,000) is based on previous efforts with similar scope.

**Communications:** Telephone, cell phone, and fax line charges are included in the F&A cost; however, direct project costs may include line charges at remote locations, long-distance telephone charges, postage, and other data or document transportation costs that can be directly identified to a project. Estimated costs are based on prior experience with similar projects.

**Printing and Duplicating:** Page rates are established annually by the university's duplicating center. Printing and duplicating costs are allocated to the appropriate funding source. Estimated costs are based on prior experience with similar projects.

**Operating Fees:** Operating fees generally include EERC recharge centers, outside laboratories, and freight.

EERC recharge center rates are established annually and approved by the university.

Laboratory and analytical recharge fees are charged on a per-sample, hourly, or daily rate. Additionally, laboratory analyses may be performed outside the university when necessary. The estimated cost is based on the test protocol required for the scope of work

Document production services recharge fees are based on an hourly rate for production of such items as report figures, posters, and/or images for presentations, maps, schematics, Web site design, brochures, and photographs. The estimated cost is based on prior experience with similar projects.

Geoscience services recharge fees are discipline fees for costs associated with training, certifications, continuing education, and maintaining required software and databases. The estimated cost is based on the number of hours budgeted for this group of individuals.

The technical software fee is a use fee for an advanced project management tool. Costs are associated with software, data entry, maintenance, and enhancement of the system.

Software solutions services recharge fees are for development of customized websites and interfaces, software applications development, data and financial management systems for comprehensive reporting and predictive analysis tools, and custom integration with existing systems. The estimated cost is based on prior experience with similar projects.

Field safety fees cover safety training and certifications, providing necessary personal protective equipment, and annual physicals. The estimated cost is based on the number of days individuals are budgeted to work in the field.

**Outside Lab – Minnesota Valley Testing Laboratories, Inc. (MVTL):** MVTL fees are for performing water analysis on the fluid used in the injection test. This cost is based on historical quotes for similar jobs.

**Facilities and Administrative Costs:** The F&A rate proposed herein is approved by the U.S. Department of Health and Human Services and is applied to modified total direct costs (MTDC). MTDC is defined as total direct costs less individual capital expenditures, such as equipment or software costing \$5000 or more with a useful life of greater than 1 year, as well as subawards in excess of the first \$25,000 for each award.

**Cost Share:** Cash cost share is being provided by the U.S. Department of Energy in the amount of \$5,150,874, and Rainbow Energy Center is providing \$643,859 of cost share.