

June 1, 2017

Ms. Karlene Fine  
North Dakota Industrial Commission  
ATTN: Oil and Gas Research Program  
State Capitol – 14th Floor  
600 East Boulevard Avenue, Department 405  
Bismarck, ND 58505-0840

Dear Ms. Fine:

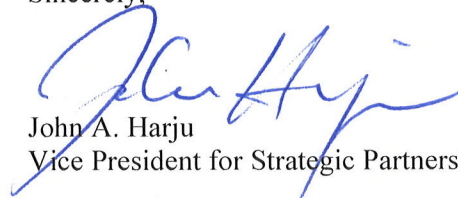
Subject: EERC Proposal No. 2017-0130 Entitled “Pipeline Study Phase III (HB 1347)” in Response to a Request from the North Dakota Legislature

The Energy & Environmental Research Center (EERC) is pleased to propose a project to include an analysis of leak detection and monitoring technology and a risk assessment of new and existing pipeline systems in an effort to decrease pipeline leak incidents, volumes, and impacts. This proposal is submitted in direct response to the mandate set forth in House Bill 1347 of the 2017 North Dakota Legislature.

Enclosed please find an original and one copy of the subject proposal along with a check for \$100. The EERC, a research organization within the University of North Dakota, an institution of higher education within the state of North Dakota, is not a taxable entity; therefore, it has no tax liability.

This transmittal letter represents a binding commitment by the EERC to complete the project described in this proposal. If you have any questions, please contact me by telephone at (701) 777-5157, by fax at (701) 777-5181, or by e-mail at [jharju@undeerc.org](mailto:jharju@undeerc.org).

Sincerely,



John A. Harju  
Vice President for Strategic Partnerships



Tom Erickson, CEO  
Energy & Environmental Research Center

JAH/bjr

Enclosures

c/enc: Brent Brannan, OGRC

# Oil and Gas Research Program

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North Dakota

Industrial Commission

## Application

**Project Title:** Pipeline Study Phase III (HB 1347)

**Applicant:** Energy & Environmental Research  
Center

**Principal Investigator:** Jay C. Almlie

**Date of Application:** June 1, 2017

**Amount of Request:** \$500,000

**Total Amount of Proposed Project:** \$500,000

**Duration of Project:** 24 months

**Point of Contact (POC):** Jay C. Almlie

**POC Telephone:** (701) 777-5260

**POC E-Mail Address:** jalmlie@undeerc.org

**POC Address:**

15 North 23rd Street, Stop 9018

Grand Forks, ND 58202-9018

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## ABSTRACT

**Objective:** The EERC proposes a project to directly address the intent of Section 3 of House Bill 1347 (Appendix A), which states that a study should be completed to “include an analysis of leak detection and monitoring technology and a risk assessment of new and existing pipeline systems.” The EERC will accomplish this work by assembling and engaging a pipeline operator stakeholder group, developing options for risk assessment protocols, analyzing a wide suite of specific risk factors (including in high consequence areas), identifying potential mitigation technologies to address those risk factors, and analyzing strategies for continuous improvement. Optional supporting tasks are also proposed herein.

**Expected Results:** The results of the proposed work will serve to inform state and industry entities on possible approaches to risk assessment, providing a rubric that can be used to calculate a semiquantitative risk score. With a known risk score, appropriate layering of risk mitigation steps can be appropriately applied. The project will assess which technologies can be applied to various risk situations and highlight risk categories in need of additional technological mitigation options. Finally, the project will investigate possible approaches to formalized continuous improvement processes for liquid gathering pipeline operations. This work will result in a marked decrease in spills and leaks associated with liquid gathering pipelines in the state of North Dakota. The promotion of a layered approach of risk mitigation in high-risk areas will result in fewer pipeline leaks, improved public relations, decreased environmental impact, decreased operating costs due to decreased cleanup activities, and correcting a false narrative that claims North Dakota experiences an inordinate frequency of spills.

**Duration:** The duration of the project will be 24 months (July 1, 2017, to June 30, 2019).

**Total Project Cost:** The base cost of the project is \$500,000. The amount requested for the core tasks from OGRC is \$500,000. Optional tasks are proposed and may be considered independently without impact to the core project. The total cost of all optional tasks is \$354,090. The amount requested from OGRC for the optional tasks is up to \$354,090.

**Participants:** Proposed participants include the EERC, NDIC OGRP, and a pipeline operator stakeholder group.

## PROJECT DESCRIPTION

The Energy & Environmental Research Center (EERC) proposes a project to directly address the intent of Section 3 of House Bill 1347 (Appendix A), which states that a study should be completed to “include an analysis of leak detection and monitoring technology and risk assessment of new and existing pipeline systems.” The EERC will accomplish this work by assembling and engaging a stakeholder group comprising pipeline operators, developing options for risk assessment protocols, analyzing a wide suite of specific risk factors (including in high consequence areas), identifying potential mitigation practices and technologies to address those risk factors, and analyzing strategies for continuous improvement. This proposal also includes several optional tasks directly related to risk assessment.

**Goals and Objectives:** The goal of this project is to reduce the frequency and total volume of leaks and spills from pipeline systems in the state of North Dakota. This goal will be supported by the following specific objectives:

- Improve industry and state knowledge of the factors influencing leaks and spills.
- Develop a comprehensive list of “risk factors” that increase the likelihood of a pipeline leak or spill, and create a process that enables operators to evaluate and prioritize risk factors for their specific pipeline system.
- Assess known mitigation strategies, and identify risk factors they are best suited to address.
- Identify continuous improvement methodologies for use in the liquid gathering pipeline sector, and suggest mechanisms for measuring success in continuous improvement protocols.
- *OPTIONAL:* Analyze effects of mixed-composition flowback in liquid gathering pipelines
- *OPTIONAL:* Analyze risks associated with the use of polyethylene risers
- *OPTIONAL:* Analyze risks associated with the employment of pinch-off techniques to stop flow through a pipeline during pipeline repairs.
- *OPTIONAL:* Investigate effects of frost heave on liquid gathering pipelines in North Dakota.

**Methodology:**

**Task 1 – Pipeline Stakeholder Group Recruitment, Definition, and Leadership**

To accomplish the work prescribed in HB 1347, the EERC will require significant input from pipeline operators, in a fashion very similar to the successful efforts of the Phase I Liquids Gathering Pipeline Study prescribed by HB 1358 in April 2015. This group will be recruited and gathered to ground-truth the knowledge developed by the EERC in semiquantitative risk assessment of pipelines, including new developments in leak detection technology that can be applied to mitigate risks associated with pipelines.

To maximize the merit of meeting with a pipeline operators group to discuss the technical details of this work and its implications, the EERC will begin with an informational day intended to ensure a common starting point for all participants. This baselining will ensure that all involved understand the goals of the effort and that all are working from a common technical knowledge base. The EERC will facilitate a period of problem definition with and by these same stakeholders. The EERC will strive to gain from the perspectives and lessons learned from experienced industry members.

Following this meeting, regular stakeholder meetings and one-on-one discussions with individual stakeholders will advance the discussion and provide opportunities to exchange information and share lessons learned. This information exchange will serve to better inform the EERC and state interests on challenges and opportunities in improving pipeline integrity in the state.

**Task 2 – Assessment of Risk Factors**

At the core of the mandate prescribed in HB 1347 is the topic of risk assessment of new and existing pipelines. Risk assessment will serve as the foundation for an improved, layered approach to risk mitigation steps, providing guidance on which pipeline systems or segments require additional attention from industry interests and state regulators. Risk assessment allows pipeline operators and policymakers/regulators the ability to prioritize the expenditure of resources (financial, permits, and regulation) on those aspects of pipelines that pose the greatest risk and ensures the greatest benefit to system performance.

The EERC will begin this task by identifying and adapting possible options for risk assessment architectures. Risk assessment is ubiquitous throughout industry. Risk assessment architectures have been

developed for other industry segments, and those architectures can likely be adapted to the topic of pipeline operations in North Dakota. The EERC will investigate other generally accepted risk assessment standards and recommend adaptations that may benefit the application of these standards to pipeline operations.

The EERC will investigate specific candidate risk factors for inclusion in generating semiquantitative risk scores. Equipment-specific factors and situational factors will be evaluated (for example, risks associated with compression fitting failures may be classified as an equipment-specific factor, while a pipeline crossing under a river tributary may be classified as a situational factor). Once a comprehensive list of risk factors is defined, industry and the EERC will work together to determine relative weights to apply to these risk factors. The end goal will be to use this weighting in a semiquantitative formula to generate a risk score for unique pipeline systems or pipeline segments. Industry will use this score to determine appropriate risk mitigation approaches. State regulators might use this score in determining appropriate regulatory measures commensurate with the risk present in individual cases. To be clear, the EERC will not determine risk scores but will only recommend a pragmatic approach to calculating scores.

With an approach to risk assessment determined, the EERC will then summarize various technologies that may be applied to mitigate the risks presented. This will not be based on any statistical information because that statistical information is generally unavailable. Rather, the project team will recommend a simple matching of risks to available and applicable risk mitigation technology options, summarized for guidance purposes. This portion of work scope will directly address the “analysis of leak detection and monitoring technology” portion of the HB 1347 mandate.

### **Task 3 – Analysis of Possible Strategies for Continuous Improvement**

An extension of risk assessment and risk mitigation is the concept of “continuous improvement,” (CI), a concept first promoted by W. Edwards Deming in Japan during recovery from World War II. CI principles are employed throughout industry and are intended to accomplish multiple goals, including workforce/public safety and economical industry operations. Several formalized approaches to CI have been employed extensively in industry: Kaizen, Six Sigma, Continuous Product Improvement, Lean Manufacturing, Total Quality Management, ISO9000, and others. The EERC will examine these

approaches to CI for compatibility with the pipeline industry, especially the gathering pipeline operation segment. The EERC will also investigate available methodologies to measure CI in the pipeline operations sector, then make recommendations to industry and state entities regarding potential application of these principles.

### **Optional Tasks**

The EERC and the North Dakota Department of Mineral Resources (NDDMR) have conferred to define the following tasks that have potential to contribute significantly to the overall assessment of risks in pipeline operations within the state. These tasks are informational for NDDMR and unlikely to receive interest in cost sharing from industry. Therefore, they are presented here as optional tasks directly related to the intent of HB 1347 and to the goals defined within this proposal. The Oil and Gas Research Council (OGRC) and the North Dakota Industrial Commission (NDIC) are invited to consider these tasks for funding and can opt to fund or not fund these Tasks without affecting the core scope of work proposed in Tasks 1–3.

#### ***Task 4 – Analysis of the Effects of Mixed-Composition Flowback within Liquid Gathering Pipelines***

An infrequent, but not uncommon, practice within liquid gathering pipeline operations is to permit mixed-composition flowback (produced fluids including some solids content) to occur during early wellsite operations and just after recompletion efforts. This mixed-composition flow can also occur during upsets in wellsite operations that impair separation of fluids from solid material. Anecdotal reports indicate that, in certain instances, this practice has led to buildup of flow-inhibiting deposits in liquid gathering pipelines that may induce additional pressure drop and contribute to overall risk of leaks in the pipeline system.

The EERC will investigate available literature on this topic to determine known frequency of occurrence, known resulting issues, and available mitigation steps to either avoid or rectify the potential issues. The EERC will also survey industry to determine frequency of practice specific to Bakken operations. The EERC will solicit information from industry to conduct case studies to further detail results of this practice. The EERC will not identify companies in any resulting report but will rather aggregate the reporting to focus on practices and results. With information collected on composition of fluids during



periods of mixed-composition flowback, the EERC will perform modeling to predict possible limits of the practice before adverse effects are realized in pipeline flow and pipeline operations. This modeling will be performed using pipeline modeling software the EERC currently possesses.

***Task 5 – Analysis of the Use of Polyethylene Risers***

A relatively recent trend among gathering pipeline operators in North Dakota involves the use of polyethylene risers in pipelines. Prior designs of risers typically used steel for the exposed sections of pipeline that rose above the surface. This may be a cost-saving measure, or there may be operational motives behind this trend. The NDDMR would like to better understand the implications of this practice, relative to pipeline integrity and pipeline performance. A better understanding of potential risks is of primary interest. To ascertain performance and risks associated with this practice, the EERC will query pipeline operators to derive a statistical approximation of the frequency of use of this practice and any known effects. The EERC will document any known failures and summarize any potential risks and benefits in a report to NDDMR and NDIC. The EERC may also make recommendations for situational employment, depending upon the results of the investigation.

***Task 6 – Investigation of the Use of Pinch-Off to Temporarily Stop Flow During Pipeline Repairs***

The EERC has been involved in discussions on the use of pinch-off of high-density polyethylene (HDPE) pipelines over the past 2 years. Reportedly, pipeline operators have been advised by HDPE pipeline manufacturers that four ASTM International (ASTM) standard practice documents specifically focused on the use of pinch-off for HDPE gas pipelines can also be utilized in guiding pinch-off procedures for liquid HDPE pipelines. During summer 2016 discussions between manufacturer representatives and EERC researchers, this discontinuity was highlighted. These discussions led to ASTM taking the issue under consideration. The EERC has been told that revisions to the standard practice documents are under way. Meanwhile, pipeline operators have been left in an indeterminate position regarding proper use of pinch-off procedures. The EERC will therefore summarize discussions held on the topic to date and summarize ASTM's work. The EERC will also seek to engage with the ASTM committee reviewing existing standard practice documents in an effort to contribute to efforts to revise the documents. In parallel, the EERC will

perform independent mechanical evaluation testing of pinch-off procedures prescribed by the ASTM documents to assess potential effects of the procedures on pipeline integrity. The EERC will design and build a mechanical test cell to perform this testing. Deviation to the codified procedures will be explored to determine sensitivity of pipeline integrity to procedural mistakes in the field.

***Task 7 – Assessment of the Potential for Frost Heave to Damage Liquid Gathering Pipelines in North Dakota***

Upheaval of soils due to uneven or erratic spring thaw cycles (frost heave) is known to occur in North Dakota's challenging climate. The extreme physical force of upheaval has potential to damage liquid gathering pipelines, especially those buried shallowly. It is currently unknown how significant the threat of upheaval is to pipeline integrity. The EERC will conduct a preliminary assessment of the threat of upheaval based on geotechnical knowledge and study of documented analog events. Because this issue may not be reported because of litigatory constraints, a statistically based investigation will likely not be possible, but a preliminary investigation may quickly determine whether cause exists to warrant further investigation. The goal of this task will be to report on a preliminary EERC assessment, leading to this determination.

**Anticipated Results:** The results of the proposed work will serve to inform state and industry entities on possible approaches to risk assessment, providing a rubric that can be used to generate semiquantitative risk scores. With a known risk score, appropriate layering of risk mitigation steps can be appropriately applied. The project will also attempt to assess which technologies can be applied to various risk situations and will highlight risk categories in need of additional technological mitigation options. Finally, the project will investigate approaches to formalized CI processes for liquid gathering pipeline operations. It is expected that this work will result in a marked decrease in spills and leaks associated with liquid gathering pipelines in the state of North Dakota. The promotion of a layered approach of risk mitigation in high-risk areas will result in fewer pipeline leaks, improved public relations, decreased environmental impact, decreased operating costs due to decreased cleanup activities, and correcting a false narrative that claims North Dakota experiences an inordinate frequency of spills.

**Facilities, Resources, and Techniques to Be Used:** In support of optional Task 6, a pipeline pinch-off mechanical test rig will be built to explore the effects of deviations to prescribed pinch-off procedures on pipeline strength and integrity. Stakeholder meetings will be held at a variety of locations across the state of North Dakota to encourage strong and consistent engagement among stakeholders. The EERC possesses large conference facilities but will also utilize public facilities in the western part of the state.

**Environmental and Economic Impacts While Project Is under Way:** None.

**Ultimate Technological and Economic Impacts:** Ultimately, it is anticipated that this activity will contribute significantly to a reduction in the frequency and volume of pipeline leaks, which will result in beneficial impacts on the environment and on company costs associated with postspill remediation activities. It is expected that this study will also result in a secondary effect. The study is likely to highlight opportunities to advance the state of the art in leak prevention and leak detection to the pipeline industry and vendors of these technologies. Subsequently, the state and industry are poised to reverse negative coverage promoted by some media outlets. This will be accomplished by applying new technologies and approaches in new ways to “raise the bar” on pipeline operations. If this activity successfully demonstrates a new approach to liquid gathering pipeline integrity assurance, other states may follow suit.

**Why the Project Is Needed:** Despite increased focus from state and industry over the past few years, liquid gathering pipeline leaks continue to vex the state of North Dakota and operators of pipelines in the state. Media coverage, especially after the intense spotlight of the Dakota Access Pipeline episode from the fall and winter of 2016/2017, continues to highlight (and sometimes exaggerate) every spill recorded in the state. To overcome the real and perceived problems of pipeline leaks in North Dakota, a new approach to risk assessment and risk mitigation is needed. North Dakota and the industry committed within its boundaries must work together to redefine the approach to leak prevention and monitoring. Together, these parties can achieve a reduction in leaks while reducing financial aspects of this activity, thereby promoting a positive perspective on the business of extraction of valuable natural resources for public, state, and shareholder benefit.

## STANDARDS OF SUCCESS

Success will be achieved when a notable decrease in the frequency and total volume of pipeline leaks is realized in North Dakota for environmental, financial, and public relations benefits to all involved parties.

### **Deliverables:**

1. Core project deliverables include:
  - a. Quarterly reports to NDIC highlighting results of ongoing project activities.
  - b. Final report to NDIC summarizing project achievements, including:
    - i. Recommendations for formalized risk assessment protocols.
    - ii. Recommendations for formalized CI protocols.
  - c. Briefings to legislative management and NDIC commissioners on request.
2. Optional task deliverables include:
  - a. Detailed sections incorporated into the final project report, including recommendations where appropriate.
  - b. Model data packages, where appropriate and defined in the scope of work.

## BACKGROUND/QUALIFICATIONS

**Personnel:** Jay C. Almlie, EERC Principal Engineer, will serve as project manager. An experienced team from the earlier work of Phase I and Phase II will be applied to this project (Phase III), including Chad A. Wocken (Principal Engineer) and Steven M. Schlasner (Research Engineer). Dr. Brian P. Kalk and John A. Harju will serve as senior project advisors. Appendix B provides resumes for these personnel.

**Energy & Environmental Research Center:** The EERC is a high-tech, nonprofit branch of the University of North Dakota, exclusively conducting contract research for a multinational client base. The EERC's oil and gas experience is highlighted within the Center for Oil and Gas, a specialized technical group focusing on design and implementation of new approaches to the exploration, development, and production of oil and gas. Related ongoing projects include the Bakken Production Optimization Program, which includes tasks focused on soil remediation and land reclamation, and the recently completed North Dakota legislature-

mandated Gathering Pipeline Study. Related projects conducted in the past include studies focused on the Williston, Powder River, Denver–Julesburg, and Alberta Basins and multiple soil and groundwater remediation efforts within the Water Management Center.

#### **MANAGEMENT**

The EERC manages approximately 226 contracts a year, with more than 1345 clients in 51 countries and all 50 states. Best practices are provided to EERC project managers and clients with regard to fund accounting, budget reporting, contract milestone tracking, and contract services. The deliverables of this proposal will be incorporated into a contract agreement ensuring timely accomplishment of milestones. Progress reports will be prepared on a quarterly basis and will serve as a means of evaluating the project with respect to budget, schedule, and technical achievement.

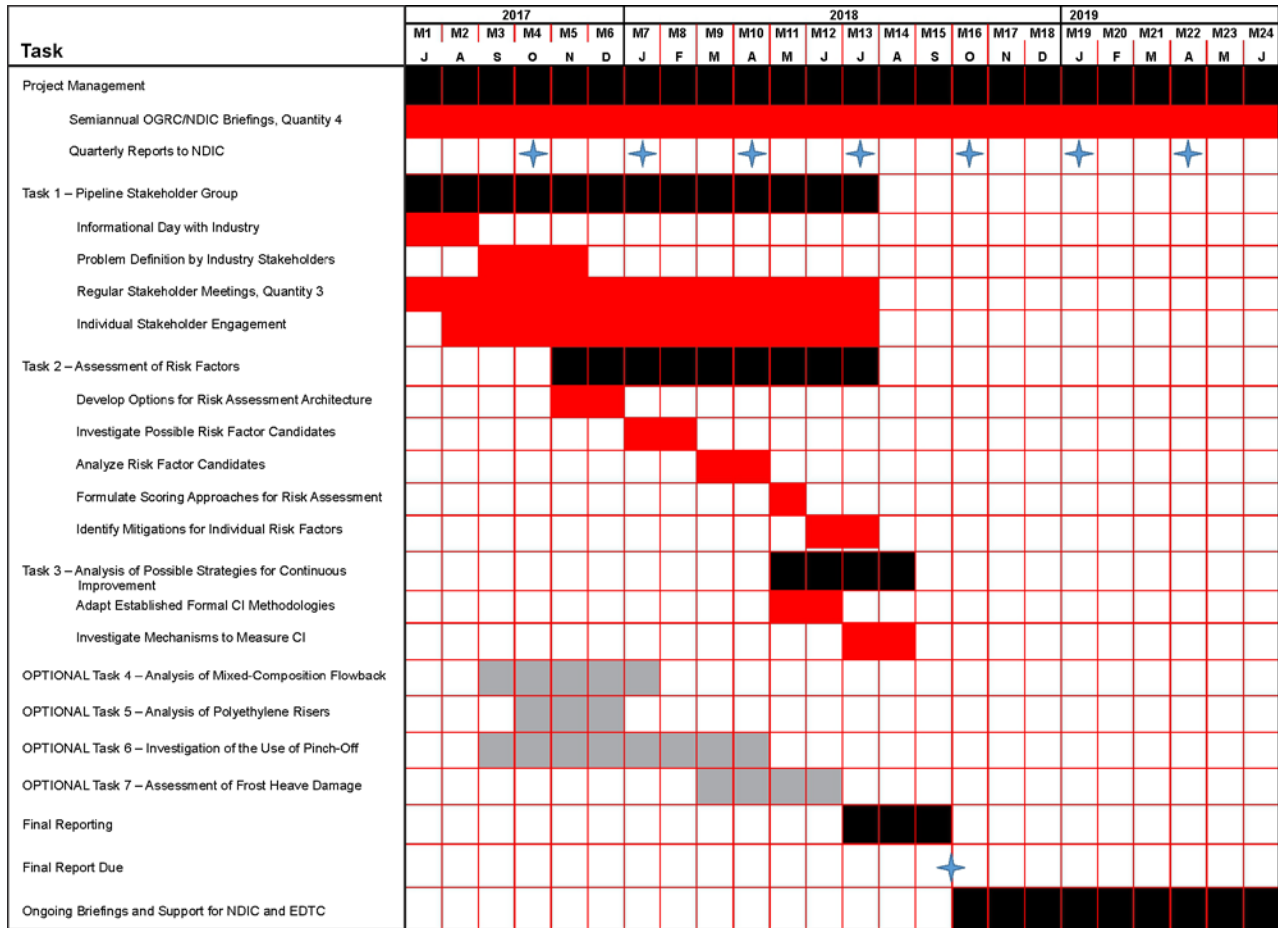
Jay C. Almlie, Principal Engineer, will oversee the project. He will be responsible for understanding technical details, budget details, schedule details, project coordination, guidance, and supervision to ensure consistent progress. Further, he will be responsible for communicating project and task progress to NDIC on a regular basis via reports and in-person meetings with NDIC and legislative management.

#### **TIMETABLE**

This project is proposed as a 24-month project beginning on July 1, 2017, and ending on June 30, 2019. The “active” research and reporting efforts will be completed by late summer of 2018 to allow for the production and review of a detailed final report for consideration by lawmakers and NDIC by fall of 2018, prior to the ensuing legislative session. The additional project months beyond fall of 2018 will allow EERC staff to provide testimony, facilitate any necessary outreach, and support NDIC as requested. Figure 1 summarizes the project timetable.

#### **CONFIDENTIAL INFORMATION**

There is no confidential information included in this proposal.



EERC JA53316.CDR

Figure 1. Preliminary project timetable.

### BUDGET

The total estimated cost for the core of the work, as mandated in HB 1347, is \$500,000. Four optional tasks (\$354,090) have the potential to contribute significantly to the overall assessment of risks in pipeline operations and are listed in Table 1 below, along with the core cost. The optional Task 6 will involve designing and building a mechanical test cell to perform the testing. Budget justification can also be found in the Appendix C. The requested funding is necessary to complete the scope of work as proposed. Consistent with the language of HB 1347, no cost share is proposed for this scope of work.

### PATENTS/RIGHTS TO TECHNICAL DATA

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

**Table 1. Budget Breakdown**

CATEGORY	CORE TASKS (1-3)	OPTIONAL				
		TASK 4	TASK 5	TASK 6	TASK 7	TOTAL
<b>Total Labor</b>	\$311,790	\$59,304	\$34,124	\$71,824	\$34,124	\$199,376
<b>Travel</b>	\$2,258	\$ -	\$944	\$3,900	\$944	\$5,788
<b>Equipment &gt; \$5000</b>	\$ -	\$ -	\$ -	\$20,000	\$ -	\$20,000
<b>Supplies</b>	\$3,979	\$1,200	\$780	\$5,000	\$780	\$7,760
<b>Communications</b>	\$750	\$100	\$100	\$ -	\$100	\$300
<b>Printing &amp; Duplicating</b>	\$773	\$200	\$200	\$200	\$200	\$800
<b>Food</b>	\$1,000	\$ -	\$ -	\$500	\$ -	\$500
<b>Rents &amp; Leases</b>	\$1,500	\$ -	\$ -	\$ -	\$ -	\$ -
<b>Laboratory Fees &amp; Services</b>						
Graphics Service	\$10,176	\$1,357	\$1,357	\$3,392	\$1,357	\$7,463
<b>Total Direct Costs</b>	\$332,226	\$62,161	\$37,505	\$104,816	\$37,505	\$241,987
<b>Facilities &amp; Admin. Rate – % of MTDC</b>	\$167,774	\$31,391	\$18,940	\$42,832	\$18,940	\$112,103
<b>Total Project Costs – U.S. Dollars</b>	<b>\$500,000</b>	<b>\$93,552</b>	<b>\$56,445</b>	<b>\$147,648</b>	<b>\$56,445</b>	<b>\$354,090</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 to the state of North Dakota or any of its political subdivisions.

**STATUS OF ONGOING PROJECTS**

The EERC is currently engaged in three OGRP-funded projects. These projects are listed below:

“Produced Fluids Gathering Pipeline Study,” Contract No. G-Produced Water Pipeline-02. Period of performance: April 20, 2015, through June 30, 2017. A Phase I final report was submitted in December 2015. A Phase II final report was submitted in December 2016. The EERC continued briefings to and support of the North Dakota Legislature during its 2017 session. Project is ongoing and current on all deliverables.

“Bakken Production Optimization Program 2.0,” Contract No. G-040-080. Period of performance: November 1, 2016, through October 31, 2019. Project is ongoing and current on all deliverables.

“Plains CO<sub>2</sub> Reduction Partnership – Phase III,” Contract No. G-015-030. Period of performance: June 23, 2008, through December 31, 2017. Project is ongoing and current on all deliverables.

**APPENDIX A**

**HOUSE BILL NO. 1347**



**Sixty-fifth Legislative Assembly of North Dakota  
In Regular Session Commencing Tuesday, January 3, 2017**

HOUSE BILL NO. 1347

(Representatives D. Anderson, Boschee, C. Johnson, Mock, M. Nelson, Schmidt, Steiner)  
(Senators Armstrong, Bekkedahl, Unruh, Vedaa)

AN ACT to amend and reenact section 38-08-04.5 of the North Dakota Century Code, relating to the abandoned oil and gas well plugging and site reclamation fund; to provide an appropriation; and to provide a report to the legislative management.

**BE IT ENACTED BY THE LEGISLATIVE ASSEMBLY OF NORTH DAKOTA:**

**SECTION 1. AMENDMENT.** Section 38-08-04.5 of the North Dakota Century Code is amended and reenacted as follows:

**38-08-04.5. Abandoned oil and gas well plugging and site reclamation fund - Continuing appropriation - Budget section report.**

There is hereby created an abandoned oil and gas well plugging and site reclamation fund.

1. Revenue to the fund must include:
  - a. Fees collected by the oil and gas division of the industrial commission for permits or other services.
  - b. Moneys received from the forfeiture of drilling and reclamation bonds.
  - c. Moneys received from any federal agency for the purpose of this section.
  - d. Moneys donated to the commission for the purposes of this section.
  - e. Moneys received from the state's oil and gas impact fund.
  - f. Moneys recovered under the provisions of section 38-08-04.8.
  - g. Moneys recovered from the sale of equipment and oil confiscated under section 38-08-04.9.
  - h. Moneys transferred from the cash bond fund under section 38-08-04.11.
  - i. Such other moneys as may be deposited in the fund for use in carrying out the purposes of plugging or replugging of wells or the restoration of well sites.
  - j. Civil penalties assessed under section 38-08-16.
2. Moneys in the fund may be used for the following purposes:
  - a. Contracting for the plugging of abandoned wells.
  - b. Contracting for the reclamation of abandoned drilling and production sites, saltwater disposal pits, drilling fluid pits, and access roads.
  - c. To pay mineral owners their royalty share in confiscated oil.
  - d. Defraying costs incurred under section 38-08-04.4 in reclamation of oil and gas-related pipelines and associated facilities.

- e. Reclamation and restoration of land and water resources impacted by oil and gas development, including related pipelines and facilities that were abandoned or were left in an inadequate reclamation status before August 1, 1983, and for which there is not any continuing reclamation responsibility under state law. Land and water degraded by any willful act of the current or any former surface owner are not eligible for reclamation or restoration. The commission may expend up to ~~one~~five million ~~five hundred thousand~~ dollars per biennium from the fund in the following priority:
    - (1) For the restoration of eligible land and water that are degraded by the adverse effects of oil and gas development including related pipelines and facilities.
    - (2) For the development of publicly owned land adversely affected by oil and gas development including related pipelines and facilities.
    - (3) For administrative expenses and cost in developing an abandoned site reclamation plan and the program.
    - (4) Demonstration projects for the development of reclamation and water quality control program methods and techniques for oil and gas development, including related pipelines and facilities.
  - f. For transfer by the office of management and budget, upon request of the industrial commission, to the environmental quality restoration fund for use by the state department of health for the purposes provided under chapter 23-31, if to address environmental emergencies relating to oil and natural gas development, including the disposal of oilfield waste and oil or natural gas production and transportation by rail, road, or pipeline. If a transfer requested by the industrial commission has been made under this subdivision, the state department of health shall request the office of management and budget to transfer from subsequent deposits in the environmental quality restoration fund an amount sufficient to restore the amount transferred from the abandoned oil and gas well plugging and site reclamation fund.
- 3. This fund must be maintained as a special fund and all moneys transferred into the fund are appropriated and must be used and disbursed solely for the purposes in this section.
  - 4. The commission shall report to the budget section of the legislative management on the balance of the fund and expenditures from the fund each biennium.

**SECTION 2. APPROPRIATION - ABANDONED OIL AND GAS WELL PLUGGING AND SITE RECLAMATION FUND - ONE-TIME FUNDING - EXEMPTION - BRINE POND AND SOIL REMEDIATION STUDIES - REPORT TO LEGISLATIVE MANAGEMENT.**

- 1. Notwithstanding section 38-08-04.5, there is appropriated out of any moneys in the abandoned oil and gas well plugging and site reclamation fund in the state treasury, not otherwise appropriated, the sum of \$5,000,000, or so much of the sum as may be necessary, to the industrial commission for the purpose of conducting brine pond and soil remediation studies, for the biennium beginning July 1, 2017, and ending June 30, 2019. The funding provided in this section is considered a one-time funding item. The industrial commission shall conduct the following studies, during the biennium beginning July 1, 2017, and ending June 30, 2019:
  - a. A study of the number of brine ponds in the north central portion of this state which were active between 1951 and 1984 and which require the remediation of salt and any other contamination from the surrounding soil. The industrial commission may contract with or cooperate with research facilities in this state to conduct the study.

- b. A study of the number of brine ponds in the north central portion of this state which were active between 1951 and 1984 and for which landowners received compensation due to contamination to the surrounding soil.
  - c. A study of the best techniques for remediating salt and any other contamination from the soil surrounding brine ponds in the north central portion of this state which were active between 1951 and 1984 as a continuation of the study conducted pursuant to section 9 of chapter 254 of the 2015 Session Laws.
  - d. A study of the best techniques for remediating soil compaction due to oil and gas operations on well and facility sites in this state. The industrial commission may contract with or cooperate with research facilities in this state to conduct the study.
  - e. A pilot project to study and to test the best techniques for remediating salt and any other contamination from the soil surrounding brine ponds in the north central portion of this state which were active between 1951 and 1984. The industrial commission may contract with or cooperate with research facilities in this state to conduct the study.
2. The industrial commission shall provide a report to the energy development and transmission committee by September 30, 2018, regarding the results of the studies conducted under this section.

**SECTION 3. OIL AND GAS RESEARCH FUND - CONTINUATION OF PIPELINE LEAK DETECTION STUDY - EXEMPTION - REPORT TO THE LEGISLATIVE MANAGEMENT.** The industrial commission shall use \$500,000, or so much of the sum as may be necessary, from the oil and gas research fund to contract with the energy and environmental research center to continue a study regarding pipeline leak detection technology, for the biennium beginning July 1, 2017, and ending June 30, 2019. The study must include an analysis of leak detection and monitoring technology and a risk assessment of new and existing pipeline systems. Notwithstanding any oil and gas research program policies, the contract does not require matching funds. The energy and environmental research center shall provide a report to the industrial commission and the legislative management by September 30, 2018, regarding the results and recommendations of the study.

\_\_\_\_\_  
Speaker of the House

\_\_\_\_\_  
President of the Senate

\_\_\_\_\_  
Chief Clerk of the House

\_\_\_\_\_  
Secretary of the Senate

This certifies that the within bill originated in the House of Representatives of the Sixty-fifth Legislative Assembly of North Dakota and is known on the records of that body as House Bill No. 1347.

House Vote:      Yeas 86              Nays 4              Absent 4

Senate Vote:      Yeas 47              Nays 0              Absent 0

\_\_\_\_\_  
Chief Clerk of the House

Received by the Governor at \_\_\_\_\_ M. on \_\_\_\_\_, 2017.

Approved at \_\_\_\_\_ M. on \_\_\_\_\_, 2017.

\_\_\_\_\_  
Governor

Filed in this office this \_\_\_\_\_ day of \_\_\_\_\_, 2017,

at \_\_\_\_\_ o'clock \_\_\_\_\_ M.

\_\_\_\_\_  
Secretary of State

**APPENDIX B**  
**RESUMES OF KEY PERSONNEL**



**JAY C. ALMLIE**

Principal Engineer, Mid/Downstream Oil & Gas Group Lead  
Energy & Environmental Research Center (EERC), University of North Dakota (UND)  
15 North 23rd Street, Stop 9018, Grand Forks, North Dakota 58202-9018 USA  
701.777.5260 (phone), 701.777.5181 (fax), jalmlie@undeerc.org

***Principal Areas of Expertise***

Mr. Almlie's principal areas of interest and expertise include oil and gas production optimization, pipeline transport of produced fluids, oilfield TENORM (technologically enhanced naturally occurring radioactive material) waste management, hydrogen generation, data acquisition and control systems, and project/program management.

***Qualifications***

B.S., Mechanical Engineering, and B.S., Engineering Management, University of North Dakota, 1995.  
Proficient in the use of LabView, AutoCad, Autodesk Inventor, MS Excel, MS Project, Rockwell Software RSLogix, and RSView Studio.

***Professional Experience***

**2009–Present:** Principal Engineer, Mid/Downstream Oil & Gas Group Lead, EERC, UND. Mr. Almlie's responsibilities include supervision and direction of a diverse group of researchers focused on oil and gas production optimization, pipeline transport of produced oilfield fluids, emission control technology development, and hydrogen generation technology development. Mr. Almlie is responsible for technical, managerial, and business development aspects of this work. Mr. Almlie has managed several successful multimillion-dollar projects during his tenure in this position.

**2006–2009:** Research Manager, Environmental Technologies, EERC, UND. Mr. Almlie's responsibilities included supervising a team of researchers focused on mercury emission control, particulate matter emission control, and hydrogen production. Mr. Almlie was also involved technically in projects in each of these areas.

**2002–2006:** Research Engineer, Environmental Technologies, EERC, UND. Mr. Almlie's responsibilities included projects involving mercury control, particulate matter emission control, and emission control for diesel systems.

**2000–2002:** Lead Mechanical Engineer–Water Systems, International Space Station Habitability Outfitting, and Deputy Project Manager, International Space Station Galley, Lockheed Martin Space Operations Company, Houston, Texas. Mr. Almlie's responsibilities included supervision of the Galley Potable Water System and Waste and Hygiene Compartment Crew Hygiene System design teams, development of system architecture and component specs, design of water system engineering development units, and thermal/fluid mechanics analysis and testing on water systems.

**1995–2000:** Mechanical Engineer, Hernandez Engineering, Inc. Mr. Almlie's responsibilities included involvement in several projects:

- Lead mechanical engineer for a Space Shuttle thermal control system upgrade, including performing thermal design, analysis, and test functions and serving as project manager for the \$1 million research project. This was one of 10 projects identified by the National Research Council as contenders to

- extend the life of the Space Shuttle fleet.
- Lead mechanical engineer for water recovery systems, including designing, testing, and analyzing a potable water tank/radiation protection system for a crew habitat vehicle; and performing project management functions.
  - Test engineer for the International Space Station Active Thermal Control System (ATCS), including thermal/vacuum testing on ISS Active Thermal Control components and participating in Analysis and Integration Team activities to ensure ISS Thermal Control System function on-orbit.

**1994–1995:** Research Assistant, School of Engineering and Mines, UND. Mr. Almlie’s responsibilities included computational fluid mechanics model generation for combustion applications using Fluent software.

**Summer 1994:** Engineering Intern, Orbital Sciences Corporation, Inc., Dulles, Virginia. Mr. Almlie’s responsibilities included performing launch vehicle dynamic separation analyses, designing payload separation system components, performing multiple stress/strain analyses on payload carrier structures.

**1991–1993:** Mechanical Engineering Cooperative Education Intern, Eagle Engineering, Inc., Houston, Texas. Mr. Almlie’s responsibilities included authoring a satellite ground tracking code, coauthoring a payload separation simulation code, and performing payload fairing separation analysis for Orbital Sciences Corporation’s Pegasus launch vehicle.

#### ***Publications and Presentations***

Has coauthored several professional publications.

#### ***Patents and Technology Disclosures***

Radiation Shield Water Tank: Microgravity Water Tank with Capillary Air/Liquid Separation Used for Radiation Shielding. June 6, 2005. NASA Technology Disclosure.

Water Membrane Evaporator. July 22, 2005. NASA Technology Disclosure.

Miller, S.J.; Zhuang, Y.; Almlie, J.C. Advanced Particulate Matter Control Apparatus and Methods. U.S. Patent 8,092,768 B2, Jan 10, 2012.

Miller, S.J.; Almlie, J.C. Removal of Residual Particulate Matter from Filter Media. U.S. Patent 8,882,926, Nov 11, 2014.

Miller, S.J.; Zhuang, Y.; Almlie, J.C. Staged Electrostatic Precipitator. U.S. Patent 9,272,291, March 1, 2016.



## **CHAD A. WOCKEN**

Principal Engineer, Fuels and Renewable Energy Lead  
Energy & Environmental Research Center (EERC), University of North Dakota (UND)  
15 North 23rd Street, Stop 9018, Grand Forks, North Dakota 58202-9018 USA  
701.777.5273 (phone), 701.777.5181 (fax), cwocken@undeerc.org

### ***Principal Areas of Expertise***

Mr. Wocken's principal areas of research include developing alternative fuel and chemical processes and innovative energy technologies. Currently, he is leading projects focused on developing and advancing alternative chemical and fuel production processes at the bench, lab, and pilot scale; and optimizing processes associated with oil and gas production and midstream operations. Mr. Wocken currently manages a group of researchers and a lab facility containing batch and continuous reactor systems capable of testing a variety of thermochemical processes.

### ***Qualifications***

B.S., Chemical Engineering, University of North Dakota, 1994

Certifications: U.S. Army Corps of Engineers Construction Quality Management, 40-hour OSHA Health and Safety, 8-hour HAZWOPER Supervisor, 10-hour Construction Safety and Health.

### ***Professional Experience***

**2009–Present:** Principal Engineer, Fuels and Renewable Energy Lead (2009–September 2015, Senior Research Manager; 2001–2009, Research Engineer), EERC, UND.

### **Project/Program Management**

- Created a process-modeling team within the EERC's Bakken Production Optimization Program, focused on applying computational modeling expertise to oil well production processes. Modeling activities are focused on addressing the competing goals of reduced fugitive emissions and gas flaring while also reducing crude oil volatility.
- Directed the EERC's associated gas-flaring mitigation activities, aiding industry partners in their efforts to identify technologies to reduce flaring. These efforts led to the creation of the Flaring Solutions Database, a clearinghouse of business and technology solutions that have the potential to utilize gas at the wellhead and reduce flaring.
- Co-managed a Defense Advanced Research Projects Agency (DARPA)-funded project that successfully developed technology to produce drop-in compatible jet fuel for the military from renewable feedstock. Activities included planning work activities, developing and executing a risk-based project management plan, coordinating activities of five project partners to meet project goals, and communicating with the DARPA project manager.
- Managed the scale-up and design of a 300-barrel/day renewable fuel pilot plant capable of producing specification-compliant jet and diesel fuels from renewable oil feedstock.

### **Technology Development and Research**

- Designed and executed an oil and gas gathering pipeline leak detection demonstration project, resulting in tangible performance improvements for three pipeline operators.
- Conducted a technical and economic assessment of alternative uses for associated gas in an effort to reduce the amount of gas being flared in the Williston Basin. Technologies evaluated included gas-



processing operations to recover natural gas liquids, the use of rich gas in internal combustion engines for transportation and power, and traditional petrochemical unit operations.

- Performed a system-level engineering evaluation of integrated algae production at a coal-fired power plant to assess carbon uptake, emission control requirements, relative scale, and the viability of water and waste heat utilization.
- Designed, fabricated, and operated several fixed-catalyst bed reactor systems to evaluate a variety of thermocatalytic processes to produce renewable fuels and chemicals.
- Conducted testing at coal-fired power plants, and developed control technologies to reduce atmospheric emission of particulate matter, mercury, and other contaminants.

**1995–2001:** Project Engineer, URS/Radian International, Salt Lake City, Utah (1997–2001), and Milwaukee, Wisconsin (1995–1997).

#### Process Design, Operation, and Optimization

- Designed groundwater remediation systems to remove BTEX compounds and chlorinated solvents from groundwater. The projects consisted of site evaluation, technology selection and design of several groundwater circulation wells, air sparge/soil vapor extraction treatment systems, and groundwater extraction with air stripper treatment technology. Design aspects included mass balance calculations, equipment design (pumps, pipe sizing, blowers, filters, etc.), equipment selection and specification, bid/construction specifications, and design drawing development.
- Performed start-up and long-term operations for a variety of groundwater remediation systems. Responsibilities included troubleshooting equipment/system malfunctions, process optimization, writing operations and maintenance manuals, establishing performance verification criteria, defining operational cost, and directing technicians' work.
- Conducted detailed reviews of industrial wastewater treatment systems to identify alternative treatment technologies, process optimizations, cost-saving measures, water reuse and zero discharge alternatives, and regulatory considerations.

#### Construction Oversight

- Provided on-site quality control oversight for several construction projects consisting of mechanical equipment installation, instrumentation and process control, building and road construction, excavation, and underground utility installation. Daily responsibilities included evaluating work for conformance with construction drawings and specifications; conducting progress meetings; coordinating subcontractor work activities; and facilitating communication between the design firm, client, and subcontractors.

#### Project Management

- Served as project manager for several large projects that were completed successfully. Activities included developing cost proposals, managing budget and schedule, equipment and subcontractor acquisition, and maintaining effective communication with the client.

**1994–1995:** Process Engineer, Archer Daniels Midland, Clinton, Iowa.

#### Plant Operation

- Supervised operations and personnel at a wet corn mill oil extraction and refining plant. Tasks consisted of prioritizing work activities, scheduling maintenance and repairing process equipment, reviewing quality control, and extensive system troubleshooting and failure analysis.

### ***Selected Publications***

- Kurz, B.A.; Stepan, D.J.; Glazewski, K.A.; Stevens, B.G.; Doll, T.E.; Kovacevich, J.T.; Wocken, C.A. *A Review of Bakken Water Management Practices and Potential Outlook*; Final Report for Members of the Bakken Production Optimization Program; EERC Publication 2016-EERC-02-06; Energy & Environmental Research Center: Grand Forks, ND, Feb 2016.
- Lord, D.; Luketa, A; Wocken, C.A.; Schlasner, S.; Aulich, T.R.; Allen, R.; Rudeen, D. *Literature Survey of Crude Oil Properties Relevant to Handling and Fire Safety in Transport*; Sandia Report No. SAND2015-1823; Sandia National Laboratories: Albuquerque, NM, and Livermore, CA, March 2015. Energy & Environmental Research Center. *Liquids Gathering Pipelines: A Comprehensive Analysis*; Report for the North Dakota Industrial Commission and the North Dakota Legislative Energy Development and Transmission Committee; Energy & Environmental Research Center: Grand Forks, ND, Dec 2015.
- Wocken, C.A. Assessment of Remote Capture Technologies to Improve Gas Utilization. Presented at the 2014 Williston Basin Petroleum Conference, Bismarck, ND, May 20–22, 2014.
- Wocken, C.A. NDPC Flaring Task Force. Presented to the North Dakota Industrial Commission, Bismarck, ND, Jan 29, 2014.
- Harju, J.A.; Wocken, C.A.; Stevens, B.G.; Almlie, J.C.; Schlasner, S.M. End-Use Technology Study – An Assessment of Alternative Uses for Associated Gas. Presentation for the North Dakota Pipeline Authority Natural Gas End-Use Technology Study Webinar, Nov 5, 2012.

### ***Synergistic Activities***

- Conducted an evaluation of liquids gathering pipelines to identify factors influencing safe and efficient operation. Activities included reviewing leak statistics to better define the nature of leaks and spills and a technical investigation into construction, installation, and operational practices. The result of the project was a summary report highlighting opportunities to improve pipeline performance.
- Coordinated field activities in which controlled leak tests were performed to evaluate gathering pipeline leak detection performance. These leak detection tests resulted in identifying operational changes that will improve leak detection sensitivity and response time.
- Co-managed a Defense Advanced Research Projects Agency (DARPA)-funded project that successfully developed technology to produce drop-in compatible jet fuel for the military from renewable feedstock. Activities included planning work activities, developing and executing a risk-based project management plan, coordinating activities of five project partners to meet project goals, and communicating with the DARPA project manager.
- Managed the scale-up and design of a renewable fuel technology capable of producing specification-compliant jet and diesel fuels from renewable oil feedstock. The pilot-scale facility to be collocated with a petroleum refinery will have the capability of processing up to 300 barrels/day of renewable oil feedstock.
- Performed a system-level engineering evaluation of integrated algae production at a coal-fired power plant to assess carbon uptake, emission control requirements, relative scale, and the viability of water and waste heat utilization.
- Designed, fabricated, and operated several fixed-catalyst bed reactor systems to evaluate a variety of thermocatalytic processes to produce renewable fuels and chemicals.



**DR. STEVEN M. SCHLASNER**

Research Engineer

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

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Phone: (701) 777-5479, Fax: (701) 777-5181, E-Mail: [sschlasner@undeerc.org](mailto:sschlasner@undeerc.org)

***Principal Areas of Expertise***

Dr. Schlasner's principal areas of interest and expertise include technologies related to hydrogen, CO<sub>2</sub>, petroleum and microbial (bio)processing and transportation, and advanced process control.

***Qualifications***

Ph.D., Chemical Engineering, The Ohio State University, 1987

M.S., Chemical Engineering, The Ohio State University, 1983

M.B.A., University of South Dakota, 1977

B.S., Chemical Engineering, South Dakota School of Mines & Technology, 1980

B.A., Chemistry and Mathematics, St. Olaf College, 1974

Licensed Professional Engineer, Ohio and Oklahoma

***Professional Experience***

**2010–Present:** Research Engineer, EERC, UND, Grand Forks, North Dakota. Dr. Schlasner conceptualizes, develops and evaluates processing and transportation technologies related to hydrogen production, carbon dioxide capture, petroleum processing and microbial bioprocessing, as well as advanced process monitoring and control technologies from early concept development through demonstration and operational evaluation. His work includes process conceptualization, process modeling and simulation using spreadsheet and process simulators (e.g. Aspen Plus®, HYSYS®, ChemCAD™, VMGSim™ and IECM), process development at laboratory through production demonstration scales, process testing and evaluation, and life cycle analysis (e.g. GREET™ and H2A). His work also includes studies and field testing related to petroleum gathering line design and leak detection, and design and dynamic modeling studies of CO<sub>2</sub> pipelines and pipeline systems with and without on-line storage.

**2001–2009:** R&D Team Lead and Chief Engineer, CO<sub>2</sub> Capture/H<sub>2</sub> Production Team, ConocoPhillips Company, Bartlesville Technology Center, Oklahoma. Dr. Schlasner led internal R&D focused on novel CO<sub>2</sub> capture technologies, served on the Executive Board of a €13 million international research consortium that developed advanced pre-combustion CO<sub>2</sub> capture technologies, and was the technical lead for sorbent-based CO<sub>2</sub> capture in a \$55 million R&D consortium funded by eight major energy companies. Additionally, he led internal R&D related to hydrogen production, managed contract hydrogen R&D, served on technical teams of joint ventures related to hydrogen production, was the co-lead of a Department of Energy hydrogen production technical team and served on a related hydrogen transportation and delivery technical team.

**1992–2001:** Refinery Senior Engineer, Phillips Petroleum Company, Sweeny Petrochemical Complex, Texas. At various times, Dr. Schlasner served as process engineer for a benzene hydrogenation, a pentane isomerization and two aromatic extraction units; operating engineer for terminals, product pipelines, water and wastewater treatment units; and advanced control engineer for several major refinery production units (e.g. a fluidized catalytic cracker and continuous catalytic reformer, CCR) as well as terminals and pipelines. During his tenure, the benzene and aromatic extraction units set production

records, he resolved a wastewater treatment issue that had received a Notice of Violation from Texas environmental regulators, and he supervised contractor design, construction, and testing of basic and advanced control systems for assigned units, terminals and pipeline. For example, he supervised construction and installation of a \$5 million (SCADA) control system upgrade to two 150-mile, olefin pipelines that received product from and delivered to numerous manufacturing facilities, and he was the plant control system representative on a new, \$180 million naphtha CCR project and \$33 million (DCS) upgrade to several refinery units' control systems.

**1991–1992:** Plastics Engineer, Corporate Engineering, Phillips Petroleum Company, Bartlesville, Oklahoma. Dr. Schlasner developed software to automate high density polyethylene plant design so as to provide quick-turnaround process design information for clients who wish to license Phillips proprietary technology. The software reduced design time and cost by more than 60% on its first application.

**1988–1991:** Process Engineer, Advanced Composites, Plastics Division, Phillips Petroleum Company, Bartlesville Research Center, Oklahoma.. At various times, Dr. Schlasner led R&D focused on improving properties, processing and cost of stampable-sheet thermoplastic prepreg, he troubleshot and resolved issues with unidirectional tape manufacture, and he automated ten manufacturing lines (i.e., he developed a flexible, proprietary control system based on the QNX® operating system capable of controlling multiple, disparate manufacturing processes).

**1987–1988:** Bioprocess Research Engineer, Phillips Petroleum Company, Bartlesville Research Center, Oklahoma. Dr. Schlasner supervised the fermentation pilot plant which performed high-density microbial-based drug and enzyme development and toll fermentations in a Biosafety Level 2 facility.

**1980–2004:** Officer, U.S. Air Force Reserve, Air Force Research Laboratory (AFRL), Ohio. Late in his career, Col Schlasner served as acting Deputy Director of the Sensors and Materials & Manufacturing Directorates, performed management studies for the directorates, advised the directorates on management of their reservists, and served on the Laboratory's Reserve Board which oversaw activities of 210 Reservists. Prior to that, he performed and supervised laboratory automation, hazardous waste bioremediation, smart sensor and other projects. He also served on a 27-person Tiger Team that was directed by the AF Chief Scientist to provide options to Secretary of the Air Force for restructuring the 5,000+ member AF Science & Technology workforce.

**1974–1978:** Second Lieutenant – First Lieutenant, U.S. Air Force Active Duty, 44th Strategic Missile Wing (SAC), South Dakota. As an active duty officer, Lt Schlasner served as the Assistant Wing Operations Scheduling Officer, commanded an Alternate Command Post-qualified missile crew, and instructed and served as a Deputy Missile Combat Crew Commander.

#### ***Academic Research and Teaching Topics***

Dr. Schlasner's master's thesis research focused on application of various classical, advanced and modern (i.e. state space) control techniques to temperature and level control of a stirred tank. His dissertation research applied an adaptive, optimal control technique based upon an extended Kalman filter to maximize biomass production of a fed-batch fermentation of *Streptomyces C-5*, an anthracycline producing streptomycete.

During the period, 2014-2016, Dr. Schlasner lectured on the topics of process dynamics and control, plant design, and professional integrity in the Department of Chemical Engineering at the University of North Dakota.

#### ***Professional Memberships***

National Hydrogen Association, Director (2006–2007)

American Chemical Society  
American Society for Microbiology  
Tau Beta Pi  
Beta Gamma Sigma

***Relevant Publications***

- Energy & Environmental Research Center. *Pipeline Leak Detection – Field Evaluation of Multiple Approaches for Liquids Gathering Pipelines*; Report for the North Dakota Industrial Commission and the North Dakota Legislative Energy Development and Transmission Committee; Energy & Environmental Research Center: Grand Forks, ND, Dec 2016.
- Energy & Environmental Research Center. *Liquids Gathering Pipelines: A Comprehensive Analysis*; Report for the North Dakota Industrial Commission and the North Dakota Legislative Energy Development and Transmission Committee; Energy & Environmental Research Center: Grand Forks, ND, Dec 2015.
- Jensen, M.D.; Schlasner, S.M.; Sorensen, J.A.; Hamling, J.A. Operational Flexibility of CO<sub>2</sub> Transport and Storage, *Energy Proc.* **2014**, *63*, 2715-2722.
- Jensen, M.D.; Schlasner, S.M.; Sorensen, J.A.; Hamling, J.A. *Subtask 2.19 – Operational Flexibility of CO<sub>2</sub> Transport and Storage*; Final Report (Feb 3 – Dec 31, 2014) for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-08NT43291; EERC Publication 2014-EERC-12-17; Energy & Environmental Research Center: Grand Forks, ND, Dec 2014.
- Miracca, I.; Ingvar Åsen, K.; Assink, J.; Coulter, C.; Curran, L.; Lowe, C.; Torres Moure, G.; Schlasner, S. The CO<sub>2</sub> Capture Project (CCP): Results from Phase II (2004–2009). *Energy Proc.* **2009**, *1* (1), 55–62.
- Garland, R.; Schlasner, S.M. Hydrogen Production: Pathways and Status. Presented at the 234th American Chemical Society National Meeting, Boston, MA, Aug 19–23, 2007.



**DR. BRIAN P. KALK**

Director of Energy Systems Development

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

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

701.777.5276 (phone), 701.777.5181 (fax), bkalk@undeerc.org

***Principal Areas of Expertise***

Dr. Kalk’s principal areas of interest and expertise include pipeline safety, species management, electric generation, and transmission planning.

***Qualifications***

Ph.D., Natural Resource Management, North Dakota State University, 2007. Dissertation: “Development of a Process that Ensures Regulatory Compliance and Stakeholder Satisfaction.”

M.S., Environmental Engineering, North Dakota State University, 2001. Thesis: “Surface Water Flow in Golden Lake.”

B.S., Social and Political Science, Campbell University, Buies Creek, North Carolina, 1991.

***Professional Experience***

**February 2017–Present:** Director of Energy Systems Development, EERC, UND. Dr. Kalk leads a multidisciplinary team of scientists and engineers focused on research, development, and commercialization of innovative energy technologies as they relate to coal utilization and emissions, carbon management, and alternative fuels and renewable energy.

**2009–January 2017:** Commissioner and Chair (2012–2014), North Dakota Public Service Commission (PSC), Bismarck, North Dakota. As a Commissioner, Dr. Kalk was responsible for maintaining the critical balance of ensuring reliable, affordable energy availability while preserving North Dakota’s natural resources, interacting with members of industry, both political parties, the media, and numerous special interest groups. He was directly involved in determining electricity rate cases; siting for energy conversion facilities involving coal, wind, and natural gas; and determining the routes of jurisdictional pipelines and power lines. He was also responsible for policy development and implementation while managing over 40 professional staff and a \$20 million budget. Dr. Kalk’s portfolios included the following:

- ***Energy Generation*** – Directly involved in the siting of over \$5.5 billion in facilities, including jurisdictional wind farms, natural gas facilities, and coal generation.
- ***Electric Transmission Lines*** – Directly involved in the siting of over \$1.2 billion in jurisdictional power lines, which included serving on the board of the two regional transmission organizations that operate in North Dakota, direct involvement in the regional electric transmission planning and cost allocation, and testifying in front of the Federal Energy Regulatory Commission (FERC).
- ***Pipeline Safety*** – Worked with stakeholders to enhance public awareness, safety, and operation of jurisdictional pipelines, including working closely with industry and the Pipeline Hazardous Material Safety Administration (PHMSA) on new and developing technologies that enhance the operation and safety of the pipelines. Also worked with the North Dakota “One Call” board and the North Dakota Common Ground Alliance to enhance the awareness of the state’s “Call Before You Dig” Program.

- **Rate Cases** – Determined fair rate of return and compensation for regulated utility companies under the PSC jurisdiction.

While at the PSC, he served as Chairman, member of the National Coal Council, President of the Midwest Regulatory Commissioners, and Chair of the National Association of Regulatory Commissioners (NARUC) Clean Coal and Carbon Management Committee. He was also part of the 2015 U.S. Department of Energy delegation that travelled to China to discuss Clean Energy Technologies and related policies, testified in front of the U.S. Senate Energy and Natural Resources Committee on critical energy policy, and provided perspective to the American Wind Energy Association on numerous occasions.

**2006–2008:** Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota. As a member of the Upper Great Plains Transportation Institute, Dr. Kalk established an interdisciplinary management and logistics program to meet the needs of transportation professionals. He was directly involved in all aspects of the program, including student recruitment and advising, research and publication, coordination of instructors, budget preparation and execution, and classroom instruction.

**1985–2006:** United States Marine Corps.

#### ***Professional Memberships***

National Coal Council

#### ***Publications and Presentations***

Has authored or coauthored numerous professional publications and presentations on a variety of technical topics.



**JOHN A. HARJU**

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  
701.777.5157 (phone), 701.777.5181 (fax), jharju@undeerc.org

***Principal Areas of Expertise***

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

***Qualifications***

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

Postgraduate course work in Management, Economics, Marketing, Education, Climatology, Weathering and Soils, Geochemistry, Geochemical Modeling, Hydrogeochemistry, Hydrogeology, Contaminant Hydrogeology, Advanced Physical Hydrogeology, and Geostatistics.

***Professional Experience***

**2002–Present:** EERC, UND, Grand Forks, North Dakota.

July 2015–Present: Vice President for Strategic Partnerships. Mr. Harju leads efforts to build and grow dynamic working relationships with industry, government, and research entities globally in support of the EERC's mission to provide practical, pioneering solutions to the world's energy and environmental challenges. He represents the EERC regionally, nationally, and internationally in advancing its strategic energy and environmental initiatives focused on conventional and unconventional oil and gas development; zero-emission coal utilization; CO<sub>2</sub> capture and sequestration; energy and water sustainability; hydrogen and fuel cells; advanced air emission control technologies, emphasizing SO<sub>x</sub>, NO<sub>x</sub>, air toxics, fine particulate, and mercury control; renewable energy; wind energy; water management; flood prevention; global climate change mitigation; waste utilization; energy efficiency; and contaminant cleanup.

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

2002–2003: Senior Research Advisor. Mr. Harju's responsibilities included development, marketing, management, and dissemination of market-oriented research; development of programs focused on the environmental and health effects of power and natural resource production, contaminant cleanup, water management, and analytical techniques; publication and presentation of results; client interactions; and advisor to internal staff.

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

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

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



2000–2002: Principal Scientist, Produced Water Management. Mr. Harju’s responsibilities included development and deployment of produced water management technologies and methodologies for cost-effective and environmentally responsible management of oil and gas produced water.

1998–2000: Program Team Leader, Soil, Water, and Waste. Mr. Harju’s responsibilities included project and program management related to the development of environmental technologies and informational products related to the North American oil and gas industry; formulation of RFPs, proposal review, and contract formulation; technology transfer activities; and staff and contractor supervision. Mr. Harju served as Manager of the Environmentally Acceptable Endpoints project, a multiyear programmatic effort focused on a rigorous determination of appropriate cleanup levels for hydrocarbons and other energy-derived contaminants in soils. He also led GRI/GTI involvement with numerous industry environmental consortia and organizations, including PERF, SPE, AGA, IPEC, and API.

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

1997: Associate Technology Manager, Soil and Water Quality.

**1988–1996:** EERC, UND, Grand Forks, North Dakota.

1994–1996: Senior Research Manager, Oil and Gas Group. Mr. Harju’s responsibilities included the following:

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

1994: Research Manager.

1990–1994: Hydrogeologist.

1989–1990: Research Specialist.

1988–1989: Laboratory Technician.

### ***Professional Memberships***

U.S. Department of Energy Unconventional Resources Technology Advisory Committee

Interstate Oil and Gas Compact Commission Energy Resources, Research, and Technology Committee  
(former Chair) and Carbon Capture and Geological Storage Task Force

National Petroleum Council

Rocky Mountain Association of Geologists

### ***Publications and Presentations***

Has authored and coauthored more than 100 professional publications.

### ***Professional Memberships***

National Petroleum Council

Interstate Oil & Gas Compact Commission; former Chair, Energy Resources, Research and Technology Committee; Member, Carbon Capture and Geological Storage Task Force

U.S. Department of Energy Unconventional Resources Technology Advisory Committee  
Rocky Mountain Association of Geologists

***Publications and Presentations***

Has authored and coauthored more than 100 publications.

**APPENDIX C**  
**BUDGET JUSTIFICATION**

## BUDGET JUSTIFICATION

### ENERGY & ENVIRONMENTAL RESEARCH CENTER (EERC)

#### BACKGROUND

The 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 between 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 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 which 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:** For the core tasks, travel includes stakeholder meetings to be held in Williston, North Dakota. For the optional tasks, travel will include site visits and an ASTM committee meeting. 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 <http://und.edu/finance-operations> (Policies & Procedures, A–Z Policy Index, Travel). Daily meal rates are based on U.S. General Services Administration (GSA) 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.

**Equipment:** A mechanical test stand will be designed and fabricated to perform independent mechanical evaluation testing of pinch-off procedures (Optional Task 6). The cost is based on engineering estimates.

**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.

**Subcontracts:** Not applicable.

**Professional Fees:** Not applicable.

**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.

**Food:** Expenditures for project partner meetings where the primary purpose is dissemination of technical information may include the cost of food. The project will not be charged for any costs exceeding the applicable GSA meal rate. EERC employees in attendance will not receive per diem reimbursement for meals that are paid by project funds. The estimated cost is based on the number and location of project partner meetings.

**Rents & Leases:** Facilities will be rented to host stakeholder meetings throughout the course of the project. The estimated cost is based on historical costs.

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

EERC recharge center rates are established annually.

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.

Graphics 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.

Shop and operations recharge fees cover specific expenses related to the pilot plant and the required expertise of individuals who perform related activities. Fees may be incurred in the pilot plant, at remote locations, or in EERC laboratories whenever these particular skills are required. The rate includes such items as specialized safety training, personal safety items, fall protection harnesses and respirators, CPR certification, annual physicals, protective clothing/eyewear, research by-product disposal, equipment repairs, equipment safety inspections, and labor to direct these activities. The estimated cost is based on the number of hours budgeted for this group of individuals.

Freight expenditures generally occur for outgoing items and field sample shipments.

**Facilities and Administrative Cost:** 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.