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October 26, 2017

Ms. Karlene Fine
Executive Director
North Dakota Industrial Commission
State Capitol, 14th Floor
600 East Boulevard Avenue, Department 405
Bismarck, ND 58505-0840

Dear Ms. Fine:

Subject: Quarterly Project Status Report Entitled "Pipeline Study Phase III" Contract No. G-043-084; UND Project – Fund 43500-UND0022445; EERC Fund 22445

Attached is the subject project status report for the period of July 1, 2017, through September 30, 2017.

Thank you for funding this work. If you have any questions, please contact me by phone at (701) 777-5260 or by e-mail at jalmlie@undeerc.org.

Sincerely,

Jay C. Almlie
Principal Engineer
Mid/Downstream Oil & Gas Group Lead

JCA/bjr

Attachment

PIPELINE STUDY PHASE III

Quarterly Project Status Report

(for the period of July 1, 2017, through September 30, 2017)

Prepared for:

Karlene Fine

North Dakota Industrial Commission
State Capitol, 14th Floor
600 East Boulevard Avenue, Department 405
Bismarck, ND 58505-0840

Contract No. G-043-084

Prepared by:

Jay C. Almlie

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October 2017

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BACKGROUND

On August 22, 2017, the Energy & Environmental Research Center (EERC) was awarded a project by the North Dakota Industrial Commission (NDIC) to continue the EERC's study of liquids gathering pipelines. The study directly addresses the intent of Section 3 of North Dakota's 65th Legislative Assembly House Bill 1347, which states that a study must be completed to "include an analysis of leak detection and monitoring technology and risk assessment of new and existing pipeline systems." The EERC is accomplishing 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.

The Phase III study will highlight new technologies identified since the Phase I study report was issued and assess their readiness for employment in the liquids gathering pipeline sector. In instances where a technology is not yet commercially applicable, the report will highlight development required to mature those technologies.

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 is supported by the following specific objectives:

- Improve industry and state knowledge of the factors influencing leaks and spills.
- Create a risk assessment process that enables operators to evaluate and prioritize risk factors for their specific pipeline system, if they are not already employing a protocol.
- Assess known risk abatement technologies, and identify situations for which each is best suited.
- Identify continuous improvement methodologies for use in the liquids gathering pipeline sector, and suggest mechanisms for measuring success in continuous improvement protocols.

The results of this study will serve to inform state and industry entities on possible approaches to risk assessment, which may facilitate appropriate layering of risk abatement approaches, including employment of technology. The study is assessing which technologies can be applied to various risk situations and is highlighting risk categories in need of additional technological mitigation options. It is hoped that this study will highlight additional areas of

focus that will result in a marked decrease in spills and leaks associated with liquids gathering pipelines in the state of North Dakota.

The following quarterly report summarizes the program activities from July 1, 2017, through September 30, 2017.

ACCOMPLISHMENTS DURING REPORTING PERIOD

- A fully executed contract with NDIC was signed on September 8, 2017.

- A stakeholder meeting was held at the EERC August 16–17, 2017. The meeting was attended by 47 representatives from 26 pipeline operations companies and two state entities. At this initial meeting, the EERC staff defined the scope of the study and requested input and feedback from experienced pipeline operators. Excellent discussion was engaged. This discussion helped to set the tone of the study and helped state entities understand initial stances from industry.

- EERC staff have initiated discussions with smart pig manufacturers to determine the limitations of that technology set relative to smaller-diameter liquids gathering pipelines and to encourage research and development (R&D) focused on smaller-diameter liquids gathering pipeline applications of these technologies.

- EERC staff have also entered discussions with unmanned aerial system (UAS) teams to explore the feasibility of employing advanced remote sensing solutions and advanced data analytics to address the challenge of pipeline leak detection. This effort will likely result in at least two research and development (R&D) proposals by these UAS teams to industry and to the state of North Dakota in the coming months.

- The EERC has proposed to pipeline operators participating in the stakeholder group an R&D consortium focused on developing new leak detection technologies and new inline inspection technologies specifically for liquids gathering pipeline systems. Several stakeholders have indicated that this function is not currently served by other pipeline research entities. Several stakeholders have responded positively, but none have yet committed to providing funding to the consortium.

- EERC staff have researched a number of documented approaches to risk assessment. An assessment of which, if any, of these approaches may be adapted to liquids gathering lines is under way. In parallel, EERC staff engaged in numerous discussions with individual pipeline operators to learn about their current formal approaches to risk assessment and to understand the challenges of applying formal risk assessment across large systems of multiple pipelines.

- The EERC project team has chosen three of the approaches mentioned above to use as illustrative examples, has defined a simplified, hypothetical pipeline system upon which these methods can be applied, and has completed a preliminary risk assessment with each method to

demonstrate principles involved and to explore the strengths and weaknesses of each approach.

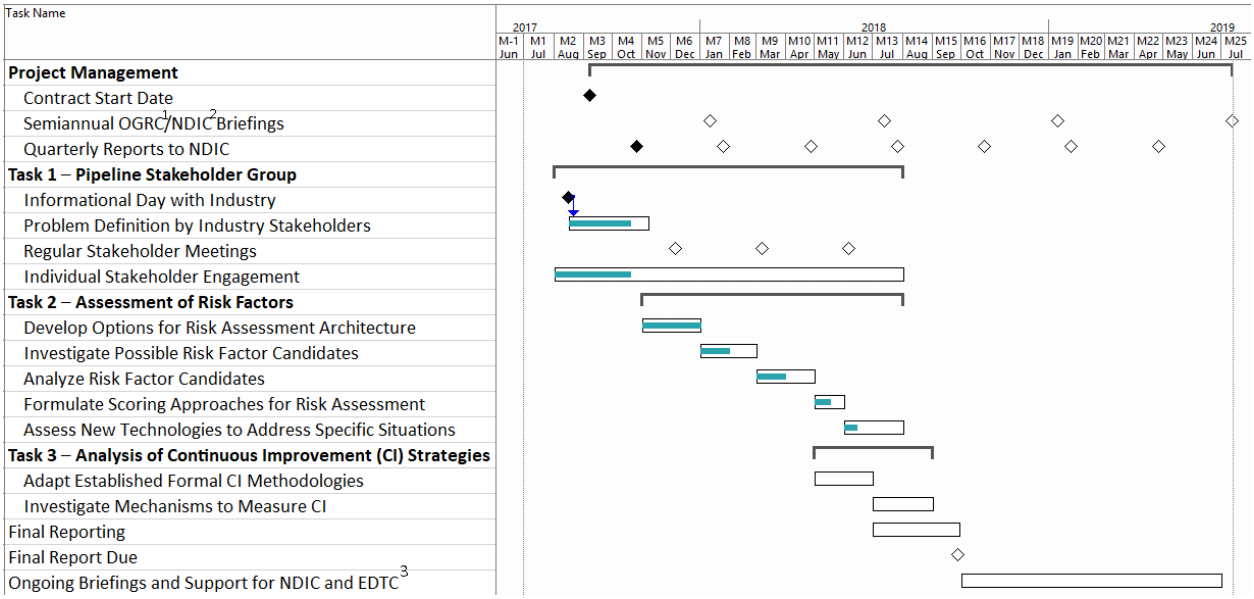
MEMBERSHIP AND FINANCIAL INFORMATION

The original budget as proposed to NDIC and the budget expended as of September 30, 2017, is shown in Table 1.

Project progress per the proposed project schedule is represented in Figure 1.

Table 1. Project Budget

Budget Category	Original Budget	Expended to Date
Total Labor	$311,790	$69,990
Other Direct Costs	$20,436	$10,256
Total Direct Costs	$332,226	$80,246
Facilities & Admininstration Rate – % of MTDC	$167,774	$40,524
Total Project Costs – U.S. Dollars	**$500,000**	**$120,770**



[1] Oil and Gas Research Council.
[2] North Dakota Industrial Commission.
[3] Energy Development and Transmission Committee.

Figure 1. Project progress.

FUTURE ACTIVITIES

The planned activities for the next quarter are detailed below.

- A second stakeholder meeting is currently planned for December 6, 2017, in Minot. At this meeting, the EERC will present its preliminary analysis of available and applicable risk assessment methodologies, then explore with the stakeholders the real-world challenges and opportunities in applying these methodologies. The discussion will also include an exploration of new technologies currently employed by pipeline operators to minimize the risk of leaks and an exploration of emerging technologies that may be ready for employment within the next 2–5 years.

- The EERC will continue to solicit industry membership in the liquids gathering pipeline consortium during the coming quarter.

- The EERC staff will continue to explore late-breaking technology developments applicable to liquids gathering pipelines.

- It is anticipated that the EERC team will complete its preliminary analysis of available and applicable risk assessment methodologies and will complete a draft of that section of the final report for review by the industry stakeholder group.

- It is anticipated that additional conversations will be held with industry volunteers to explore additional companies' approaches to formal risk assessment of their liquids gathering pipeline systems.

- The EERC team will begin an exploration of continuous improvement principles that may be applied to liquids gathering pipelines.