

Technical Reviewers' Rating Summary

Proposal Number **G-023-050** Application Title **Investigation of Improved C** Submitted By
Energy & Environmental R Request For **\$150,000.00** Total Project Costs
\$332,432.00

Section A. Scoring

Statement	Weighting Factor	G-023-A1	G-023-A2	G-023-A2	Average Weighted Score
1. Objectives	9	4	4	4	36
2. Achievability	7	4	3	3	21
3. Methodology	8	4	3	4	24
4. Contribution	8	4	4	3	24
5. Awareness / Background	5	5	4	3	20
6. Project Management	3	5	3	3	9
7. Equipment / Facilities	2	5	3	4	8
8. Value / Industry - Budget	4	4	4	4	16
9. Financial Match - Budget	4	4	3	3	12
Average Weighted Score		210	176	173	186

Total: 50

250 possible points

OVERALL RECOMMENDATION

FUND **X** **X** **X**
 FUNDING TO BE
 CONSIDERED
 DO NOT FUND

Section B. Ratings and Comments

1. The objectives or goals of the proposed project with respect to clarity and consistency with North Dakota Industrial Commission/Oil and Gas Research Council goals are:

The project supports the statutory goals & purposes. Specifically, the project can "positively impact ultimate recovery from North Dakota's existing oil and gas pools" and "develop baseline information that will lead to other projects, processes, ideas, and activities.

- Reviewer: G-023-A1

- Rating: 4

Objectives will focus on two possible areas of concern for draining the Bakken and Three Forks from a single wellbore; Proppant bed damage and formation face damage. One concern is there seems to be a preconceived notion that there is a proppant bed in the lower Bakken shale. Fluid migration during closure may in fact move proppant out of this layer. Fracture closure modeling may help identify if this is a reason for lack of commingled production.

- Reviewer: G-023-A2

- Rating: 4

I believe the goals are very clearly stated. This subject is of concern to many of the Producing Companies in the Williston Basin and industry is looking at many different factors that may contribute to the lack of conductivity between the Three Forks and Bakken Formations. This project would address one of those factors.

- Reviewer: G-023-A2

- Rating: 4

The reviewers' comments are insightful regarding the consideration of factors outside of the project scope. Ultimately, if identification of conductivity loss from the proposed mechanisms would prove inconclusive, it would suggest greater emphasis be directed towards fracture closure modeling.

- Applicant

2. With the approach suggested and time and budget available, the objectives are:

My opinion is the objectives are achievable. I have some experience with classical Cooke conductivity cell, but I have never used the Hoek cell apparatus. Provided the Hoek apparatus works as anticipated, the objectives are achievable.

- Reviewer: G-023-A1

- Rating: 4

Since most of the work is lab related the schedule should be achievable. Some of the testing takes time so if there are misruns then the time can become extended very quickly.

- Reviewer: G-023-A2

- Rating: 3

I believe the objectives are only likely achievable. The time line has adequate time for the testing I believe, but wrapping up the analysis on the data generated may take longer and possibly go over budget, that would be my major concern.

- Reviewer: G-023-A2

- Rating: 3

No comment

- Applicant

3. The quality of the methodology displayed in the proposal is:

I like the willingness of the researchers and the North Dakota Geological Survey to support

the project. Conductivity tests with Bakken core is needed.

- Reviewer: G-023-A1

- Rating: 4

This is a common process fro evaluation.

- Reviewer: G-023-A2

- Rating: 3

The quality of methodology is well done. Most of the testing parameters are industry accepted and if honored will generate good quality data.

- Reviewer: G-023-A2

- Rating: 4

No comment

- Applicant

4. The scientific and/or technical contribution of the proposed work to specifically address North Dakota Industrial Commission/Oil and Gas Research Council goals will likely be:

As previously noted, the technical contributions support the statutory goals & purposes. The results of the testing, and the interpretation of the results, can have an immediate effect on fracture design, fracture optimization, and ultimate recovery.

- Reviewer: G-023-A1

- Rating: 4

Depending on the findings. If it is possible to improve the communication between formations with a change in fluid, proppant, or design then it will hve a significant affect on the number of wells required to produce both formations.

- Reviewer: G-023-A2

- Rating: 4

I only think the contribution will be significant. I say this because there are several other factors that contribute to the lack of conductivity outside the scope of this project. Rock boundary stress's between the Three Forks and Bakken can severely effect which way the frac grows. Whether the initial frac is generated from the Three Forks up or the Bakken down is still unknown and can vary in many of the geographic areas. They do have fluid testing factored in because this can directly influence frac heights and growth direction. It may just be one piece of the puzzle but still definitely needed.

- Reviewer: G-023-A2

- Rating: 3

The quality of the project relies on a focused effort to consider conductivity loss relative to rock face degradation, or proppant degradation after stimulation. The project team recognizes other factors that influence fracture design, however localized geologic properties and rock mechanics cannot be incorporated into the study without compromising the quality of the research investigation within the given budget.

- Applicant

5. The background of the principal investigator and the awareness of current research activity and published literature as evidenced by literature referenced and its interpretation and by the reference to unpublished research related to the proposal is:

The proposal supports claims with relevant literature.

- Reviewer: G-023-A1

- Rating: 5

I was not clear who the principle investigator will be. But the overall team seems very capable and Mike Vincent is very qualified.

- Reviewer: G-023-A2

- Rating: 4

I believe its adequate because some of the above mentioned factors are being looked at in studies by other operators and service companies, concurrently. I suggest they do some additional literature searches throughout this testing process because of the dynamic nature of this subject in the industry right now.

- Reviewer: G-023-A2

- Rating: 3

Agreed, it is essential to stay abreast of new information; in our experience the developing techniques and knowledge are best obtained from events that enable dialogue with operators, service companies, and consultants. In many cases, the published literature surfaces late relative to the need for information.

- Applicant

6. The project management plan, including a well-defined milestone chart, schedule, financial plan, and plan for communications among the investigators and subcontractors, if any, is:

Well planned and documented.

- Reviewer: G-023-A1

- Rating: 5

There appears to be some flex time in the schedule for minor delays and lab issues.

- Reviewer: G-023-A2

- Rating: 3

I like the milestone chart, schedule and financial plan, however the plan for communications amongst the investigators and subcontractors needs to be spelled out much better. When and where they will review etc.

- Reviewer: G-023-A2

- Rating: 3

Meetings with the investigators and subcontracts will be monthly. Location will vary based on current activity.

- Applicant

7. The proposed purchase of equipment and the facilities available is:

My understanding is that the required equipment is currently functional, and additional equipment or facilities will not need to be purchased.

- Reviewer: G-023-A1

- Rating: 5

I did not see where there would be any purchase of equipment or facilities.

- Reviewer: G-023-A2

- Rating: 3

Most of the needed equipment is in place at the labs of which equipment parts may be needed as the testing proceeds. This portion of the project and its needs are well justified to generate the data.

- Reviewer: G-023-A2

- Rating: 4

No comment

- Applicant

8. The proposed budget “value”¹ relative to the outlined work and the commitment from other sources is of:

I believe the value of the proposed work is very good.

- Reviewer: G-023-A1

- Rating: 4

No comment

- Reviewer: G-023-A2

- Rating: 4

I think the budget value from may be Notably good where this study can boost a better EUR and overall completion practices for a relatively small investment. Commitment from other sources may need to be better defined.

- Reviewer: G-023-A2

- Rating: 4

No comment

- Applicant

9. The “financial commitment”² from other sources in terms of “match funding” have been identified:

The majority of the cost is shared by DOE and CARBO Ceramics.

- Reviewer: G-023-A1

- Rating: 4

This criteria is met.

- Reviewer: G-023-A2

- Rating: 3

The financial commitment from other sources may need to be looked at further. I believe they could get "matched funding" from other sources with some additional effort.

- Reviewer: G-023-A2

- Rating: 3

The EERC is flexible to potentially accommodate additional support over the course of the project where deemed appropriate, and welcome to suggestions.

- Applicant

1 "value" – The value of the projected work and technical outcome for the budgeted amount of the project, based on your estimate of what the work might cost in research settings with which you are familiar. A commitment of support from industry partners equates to a higher value.

2 "financial commitment" from other sources – A minimum of 50% of the total project must come from other sources to meet the program guidelines. Support less than 50% from Industrial Commission sources should be evaluated as favorable to the application; industry partnerships equates to increased favorability.

General Comments

I like the concept of testing propped fracture conductivity with Bakken and Three Forks core. The work should be immediately beneficial to help understand Bakken completions and production.

- Reviewer: G-023-A1

I think there is no doubt that the ISP's will show a benefit over natural proppants but is that all that is required. There are several operators currently running all ISP treatments it may be worth while to also investigate production results. I would suggest that a lower pH Zr crosslinked water based frac fluid also be investigated along with the high pH borate system. While penetrometer testing with water will show the fluid effect on the formation it will not show a difference in fluid performance in the Hoek cell testing.

- Reviewer: G-023-A2

The project is a bit flawed as previously mentioned in relation in my opinion due to many factors influencing the conductivity between bounding layers outside the scope of this project. The data generated and conclusions may not be the "Silver Bullet". They may need more time to evaluate and summarize the data between parties than identified. They also seem to be lacking in identifying the check points in the time table between parties to see how timeline progress is advancing and also address how they will handle cost over runs outside the budget from "other sources". Merits of this project can add many additional bbls of recoverable oil (higher EUR's) at a more economic price and open up much more marginal acreage areas where a Producer can benefit from both reservoirs from one main wellbore. It will also help cut down the foot print needed at surface potentially for the drilling and completion pad. This rolls down into less fluids needed etc which all can contribute to a lower bottom line on a \$/bbl recovery for industry.

- Reviewer: G-023-A2