Technical Reviewers' Rating Summary

Proposal Number G-58-02 Application Title Maximizing Production from Submitted By Cobra Oil & Gas Request For $2,000,000.00 Total Project Costs $4,000,000.00

Section A. Scoring

Statement	Weighting Factor	G-58-02	G-58-02B	G-58-02C	Average Weighted Score
1. Objectives	9	**3**	**3**	**3**	**27**
2. Achievability	7	**5**	**3**	**4**	**28**
3. Methodology	8	**3**	**3**	**4**	**24**
4. Contribution	8	**3**	**4**	**3**	**24**
5. Awareness / Background	5	**3**	**4**	**5**	**20**
6. Project Management	3	**4**	**3**	**3**	**9**
7. Equipment / Facilities	2	**4**	**3**	**2**	**6**
8. Value / Industry - Budget	4	**5**	**4**	**4**	**16**
9. Financial Match - Budget	4	**4**	**4**	**3**	**12**
Average Weighted Score		**181**	**171**	**177**	**176**
	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 proposed project aims to enhance oil production from a field located in the Mississippian Mission Canyon Formation in Renville County. The primary focus is on tapping into the oil stranded in residual oil zone (ROZ) accumulations. These ROZ accumulations represent a significant untapped resource that can contribute to increased oil production. By implementing advanced techniques and technologies specifically designed for targeting ROZs, the project seeks to unlock the trapped oil and maximize production from this formation. The successful implementation of this proposal has the potential to significantly enhance oil recovery and contribute to the overall energy production in the region.
   - Reviewer: G-58-02
   - Rating: 3

   The proposed CO2 EOR project in the Mission Canyon group of the Madison formation fits well with the goals of the ND OGRP. There is a significant residual oil and gas resource potential remaining within the Williston Basin from decades of primary production and secondary recovery and this research may help to unlock economic recovery, while also

making use of regional industrial CO2 production. These legacy producing formations, and the hydrocarbon resources within, have been relatively ignored in recent years due to the huge profile of the current Bakken and Three Forks development but are worthy targets in their own right.
- Reviewer: G-58-02B
- Rating: 3

The goals of the project are clearly in line with respect to the OGRC goals. However, standards of success are quite vague with little in the way of a provided benchmark such as a percentage increase in production to qualify success.
- Reviewer: G-58-02C
- Rating: 3

The scope of this project does not encompass CO2 injection. Rather, it draws correlation to the potential of CO2 injection based on the EOR results of depressurization. Through the method of depressurization, Cobra has empirically improved oil production 250%-500% and doubled oil cut on each well that reservoir deliverability and artificial lift take away has increased. A standard of success should be viewed from creating a reliable reservoir model to accurately predict intervals of application within a field to repeat the results Cobra has yielded the past 4 years.
- Applicant

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

No comment
- Reviewer: G-58-02
- Rating: 5

A large portion of the research information is already in existence and simply needs to be compiled and reviewed for this project. No new wells are planned, a significant financial cost, so that should greatly reduce upfront capital requirements and the risk associated with drilling and completion. The target resource will be an existing field with the majority of required production and operations infrastructure already in place. The largest uncertainty will likely be the time frame from the initiation of CO2 injection until when the project results can be gathered and quantified.
- Reviewer: G-58-02B
- Rating: 3

The suggested approach with respect to time and budget available should be more than sufficient for a field-level project of this scale.
- Reviewer: G-58-02C
- Rating: 4

CO2 injection will not take place within this project due to unavailability. Research already exists that proves CO2 injection to be beneficial for improving oil production of a reservoir. This project is dedicated to further proving the Madison Group to be a residual oil zone by the use of depressurization.
- Applicant

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

The study proposes to extend and develop an understanding concerning the application of formation pressure control and CO2 injection in the successful extraction of currently stranded oil in the Mission Canyon. The methodology is reasonable especially given that there is current production that supports the idea that is being tested.

- Reviewer: G-58-02
- Rating: 3

The majority of the methodology is simply data gathering and organization, in regard to the Madison Mission Canyon resource within the Williston Basin. The research portion will likely require development of a unique EOR implementation plan for the targeted formation and producing field. Some of that will be derived using the acquired resource data and also background research of previous CO2 EOR efforts to determine critical similarities and differences. Operationally, the implementation of a CO2 injection program potentially will require infrastructure adjustments, especially in the production wells and facilities once CO2 is recovered along with oil and gas.
- Reviewer: G-58-02B
- Rating: 3

While not necessarily groundbreaking with respect to field-characterization methodology, the addition of reservoir simulation software does add a level of quality that is unavailable to smaller operators.
- Reviewer: G-58-02C
- Rating: 4

CO2 will not be applied nor handled in the field within the scope of this project, so no equipment upgrades for CO2 will be required. Research shows that 2 proven methods are used to increase oil production of a residual oil zone. Those methods are CO2 injection & depressurization. Depressurization will be the choice method for this project. Any equipment upgrades will be for handling increased volumes of produced liquid associated with depressurizing the residual oil zone. From this project a predictive model can be created to accurately repeat the success Cobra has experienced which would be available for all operators of Madison production, regardless the size.
- 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:

The hypothesis of this study is that by reducing formation pressures, either through the injection of CO2 or through other methods, there is a potential to recover significant new volumes of oil from the targeted reservoirs and similar formations. To test this hypothesis, the study will involve a comprehensive approach that includes compiling existing data, conducting sampling of available core samples, and performing additional laboratory analyses. These analyses will aim to evaluate and model the reservoir properties and their response to different production schemes at the field scale. By integrating the gathered information, the study seeks to gain insights into the feasibility and effectiveness of pressure reduction techniques in enhancing oil recovery from these reservoirs, thus contributing to the advancement of oil production technologies.
- Reviewer: G-58-02
- Rating: 3

Although CO2 EOR has been implemented in many oilfields in nearby Canada and other areas of the USA, it has yet to see large scale application in the ND portion of the Williston Basin. Expansion of CO2 EOR into the ND portion of the Williston Basin will potentially expand on research and result in Canada, while also helping to develop uses for the extensive CO2 sources in the surrounding region.
- Reviewer: G-58-02B
- Rating: 4

Mission Canyon reservoir systems often contain unique features that may prevent a widespread technical application of discovered methodology to other Mission Canyon fields.

While this methodology has been proven in other carbonate reservoirs in other basins, the potential of the technical contribution being groundbreaking is somewhat unlikely.
- Reviewer: G-58-02C
- Rating: 3

Cobra has identified close correlation of core, rock saturation, petrophysical & reservoir data of Madison fields throughout North Dakota to that of the project field. Throughout the Williston Basin, the Madison is a prolific water driven reservoir with consistent trapping mechanisms and reservoir behaviors. Cobra has successfully applied this same technique in 2 different Madison sub intervals > 40 miles apart. At this time, data and results show that similar responses to that of the project field are more likely to be widely applicable than not.
- 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:

Much of the proposed work is derived from past experience in the field being studied and is therefore not dependent upon an extensive literature review. The principal investigator appears to be well qualified and familiar with the field and study being proposed.
- Reviewer: G-58-02
- Rating: 3

The EERC, in particular, with its multi-faceted carbon dioxide research programs involving a significant part of North America is uniquely positioned to help lead in this project.
- Reviewer: G-58-02B
- Rating: 4

The background of the principal investigators from both Cobra Oil and Gas as well as EERC should be more than sufficient to accomplish the proposed tasks.
- Reviewer: G-58-02C
- Rating: 5

No comment.
- 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:

The project management plan outlined for this study appears to be comprehensive and well-structured. The inclusion of activities such as data compilation, core sampling, and laboratory analysis reflects a thorough approach to evaluating and modeling reservoir properties and their response to different production schemes. By leveraging the collected data, the EERC will develop field-scale computer models to guide the optimization and implementation of successful production strategies within the ROZs. Additionally, the involvement of Cobra in conducting field tests of these models demonstrates a practical approach to validate the effectiveness of the proposed strategies. The expectation of significant improvements in production as a result of these tests further emphasizes the project's potential impact and underscores the importance of its successful execution.
- Reviewer: G-58-02
- Rating: 4

The EERC is well versed in the protocols involved in project reporting and should provide adequate management of the project. Cobra will be primarily involved in the final part of field testing. A mentioned before, the results part of any EOR project has the most uncertainty in regard to timing and reporting.

- Reviewer: G-58-02B
- Rating: 3

The project management plan does not appear to contain a great deal of detail regarding project management beyond quarterly reports but is adequate.
- Reviewer: G-58-02C
- Rating: 3

Cobra has cataloged 4 years' of well documented research and field results. These empirical results will be analyzed and used to better predict project result prior to application. The information provided by Cobra will help expedite fine tuning of project management and give a comparative metric for tracking milestones.
- Applicant

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

The proposed purchase of equipment and the availability of facilities for the project is outlined as follows: - Labor - Engineering and Field: The total expense for labor, including engineering and field work, is $605,000. The NDIC share is $250,000, and Cobra's share is $355,000. - Facilities, Equipment, Gathering: The total expense for facilities and equipment is $365,000. Both the NDIC and Cobra share this cost equally, with each contributing $365,000. - Stimulation: The total expense for stimulation is $1,050,000. The NDIC share is $350,000, while Cobra's cash contribution is $700,000. - Well Service Rigs: The total expense for well service rigs is $425,000. The NDIC share is $200,000, and Cobra's share is $225,000. - Downhole Production Equipment: The total expense for downhole production equipment is $550,000. The NDIC share is $200,000, and Cobra's share is $350,000. - Travel: The total expense for travel is $5,000. Both the NDIC and Cobra contribute $5,000. - Subcontractor - EERC: The total expense for subcontracting the EERC is $894,120. The NDIC share and Cobra's share are both $894,120. - Undesignated Third-Party Laboratory: The total expense for using an undesignated third-party laboratory is $105,880. Both the NDIC and Cobra contribute $105,880. The breakdown of expenses and the allocation of shares between the NDIC and Cobra indicate a collaborative effort in funding and supporting the project. Each aspect of the project, from labor to equipment and subcontracting, has been accounted for, demonstrating a well-organized and comprehensive approach to project planning and resource allocation. It is also worth noting that Cobra maintains a substantial amount of equipment and facilities for this work.
- Reviewer: G-58-02
- Rating: 4

Outside of the possible production infrastructure changes that may be required in the field-testing phase of the research project, due to CO2 recovery, nearly all informationally resources are in place and just require gathering and organization for the research.
- Reviewer: G-58-02B
- Rating: 3

Without more information as to the specific use of purchased downhole production equipment, a lack of clarity exists for justification.
- Reviewer: G-58-02C
- Rating: 2

Since CO2 is not associated in the field application of this project, the only equipment upgrades will be for the purpose of increased liquid handling from depressurization. Of these equipment upgrades, some equipment will be for surface handling and some equipment will be downhole. The downhole equipment upgrades are for increased artificial lift takeaway. In example, rod lift applications will need to be converted to progressive cavity pump or ESP. Cobra has converted 14 wells to progressive cavity pump, and the cost of a single well

upgrade is approximately $130,000 in equipment alone.
- Applicant

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

   The costs associated with using an active oil field for research purposes only would be prohibitive and in the absence of an industry partner not likely to be ever considered. The value attached to this is very high.
   - Reviewer: G-58-02
   - Rating: 5

   The use of an entire oilfield for the CO2 EOR project greatly enhances the potential value.
   - Reviewer: G-58-02B
   - Rating: 4

   The proposed budget should be more than adequate for this type of project.
   - Reviewer: G-58-02C
   - Rating: 4

   This project will use the method of depressurization of the residual oil zone to draw predictive comparison of results for later applied CO2 injection.
   - Applicant

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

   To evaluate the previous response in terms of "value" and "financial commitment" from other sources, let's analyze the provided table and compare the contributions of NDIC and Cobra: 1. Value: The value of the projected work and technical outcome for the budgeted amount can be assessed based on the estimated costs in research settings. While the table doesn't provide the exact total project cost, we can see that the NDIC share contributes significantly to each expense category. This suggests a considerable investment from NDIC, indicating a higher value for the project. Additionally, the involvement of Cobra with their cash contributions enhances the overall value, as industry support equates to a higher value. 2. Financial commitment: According to the program guidelines, a minimum of 50% of the total project funding should come from other sources apart from the Industrial Commission. In the table, we can observe that the NDIC share and Cobra's cash contributions are both substantial in most categories. This indicates a favorable evaluation in terms of financial commitment, as the support from the Industrial Commission (NDIC) represents less than 50% of the total project cost. Furthermore, the partnership with Cobra strengthens the financial commitment, leading to increased favorability. In summary, based on the provided table, the NDIC contribution relative to Cobra demonstrates a significant financial commitment from both sources. This aligns with the program guidelines, where a minimum of 50% funding from sources other than the Industrial Commission is required. The substantial contributions from NDIC and Cobra, along with the added value of industry support, contribute positively to the project's evaluation in terms of both value and financial commitment. The support from Cobra is evenly split with the NDIC and therefore meets the programs guidelines.
   - Reviewer: G-58-02
   - Rating: 4

   The financial commitment of 50% in cash by Cobra doesn't include the inherent value of the use of their oilfield for the duration of project.
   - Reviewer: G-58-02B
   - Rating: 4

   Given the limited benefit to other operators that this type of project may result in, the financial commitment from Cobra is somewhat limited as they may end up as the sole

beneficiaries of this type of project.
- Reviewer: G-58-02C
- Rating: 3

Over the past 4 years, Cobra has spent millions of dollars in the project field in order to accumulate the current result database. This database of results will be shared for the greater understanding of the project. Labor, geology nor engineering provided by Cobra is captured in these millions of dollars that have been spent in the project field. This empirical database will be shared for no retroactive cost of the proposed project. Of the project field, there are 4 direct offset operators that would benefit from the final results. Also, due to the consistent nature of certain Madison sub intervals, there are many operators of Madison fields throughout North Dakota that would greatly benefit from the results of this project. The Madison has produced > 1,000,000,000 barrels of oil statewide, the success of the Madison has never been localized.
- 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

The proposed project includes several interesting ideas. Merits: 1. Significant Value: The project demonstrates a considerable value for the budgeted amount, as indicated by the substantial contributions from both the NDIC and Cobra. This suggests that the project has the potential to deliver valuable outcomes and technical advancements. 2. Industry Partnership: The involvement of Cobra with their cash contributions signifies a strong industry partnership. This partnership adds value to the project, indicating that it has garnered support and recognition from external sources. 3. Favorable Financial Commitment: The financial commitment from the NDIC and Cobra exceeds the minimum requirement of 50% funding from sources other than the Industrial Commission. This favorable evaluation suggests a strong commitment to the project's success and indicates potential confidence in its outcomes. Overall, the proposed project demonstrates several strengths, including significant value, industry partnership, and a favorable financial commitment.
- Reviewer: G-58-02

It will be interesting to see how the many engineering and technological issues of implementing a CO2 injection program in an oilfield containing older wells, especially on the production side of the facilities and wellbores. Dealing with the corrosion and scaling aspects of wells producing both CO2, H2S, and high calcium content brines will likely be complex, and the implemented solutions interesting.
- Reviewer: G-58-02B

Overall, I believe this project is very likely to result in increased production from the project field. As stated, the increases in tax revenue, royalties and job creation will create local and statewide value for North Dakota. However, given the high potential of the projects findings to be applicable only at a local field level and that Cobra Oil & Gas will most likely benefit the most from that result, it would have been better if a higher contribution of 66% or greater of funding was borne by Cobra Oil & Gas.
- Reviewer: G-58-02C