TECHNICAL REVIEWERS' RATING SUMMARY

G-021-B

Simul-Frac two Bakken Wells Spaced 1320' Apart to Maximize OOIP Recoveries

Submitted by Peak North Dakota, LLC

Request for $750,000; Total Project Costs $11,450,618

Rating Category	Weighting Factor	Technical Reviewer 21B-01 Rating	21B-02 Rating	21B-03 Rating	Average Weighted Score
Objective	9	3	5	4	36.0
Availability	9	2	5	4	33.0
Methodology	7	2	2	4	18.7
Contribution	7	3	3	4	23.3
Awareness	5	4	4	4	20.0
Background	5	3	3	5	18.3
Project Management	2	4	3	4	7.3
Equipment Purchase	2	5	5	5	10.0
Facilities	2	3	5	5	8.7
Budget	2	5	1	5	7.3
Average Weighted Score		149	188	211	**182.7**
Maximum Weighted Score					**250**

OVERALL RECOMMENDATION

	21B-01	21B-02	21B-03
FUND			X
FUNDING TO BE CONSIDERED	X	X	
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: 1 – very unclear; 2 – unclear; 3 – clear; 4 – very clear; or 5 – exceptionally clear.

Reviewer 21B-01 (Rating: 3)

The formulated objectives are centered on providing a second data point for the optimization of the spacing of the wells drilled into Bakken**. However, no discussion of how these data will be applicable to a wider area within Bakken is given**.

Reviewer 21B-02 (Rating: 5)

The objectives, while limited in scope, are exceptionally clear. The objectives are supportive of NDIC goals to promote new techniques and promote efficient development.

Reviewer 21B-03 (Rating: 4)

The applicants provided an excellent summary of their objectives in the proposal. The objectives align well with the statutory goals of the OGRC.

Peak response:

This second proposed simul-frac will be taking place approximately 8 miles from the original test in order to reduce the variability in geologic differences as much as is possible. In addition, there will be several wells within 12 miles of this second test which used the same updated frac technique but were completed individually rather than simultaneously to use in comparing production results. With publicly available data from a core that is ~3 miles from this test and several OH wireline logs also available, individual operators should easily be able to correlate results from this geologic setting to the geology in their areas of interest to determine if these techniques are also applicable there. The Peak technical staff has already made these correlations to areas both 30 and over 100 miles away using available core and wireline from those areas tied together with regional cross sections. Peak determined that in these areas where porosity, permeability, oil saturations, lithology of the target zones and other key factors indicated that very similar geologic conditions existed, this same proposed frac technique and lateral placement would likely be just as effective there as in the test area and would therefore warrant additional testing. Peak is confident that other operators will likewise be able to draw similar conclusions using their own data for areas where they have an interest in conducting operations.

2. With the approach suggested and time and budget available, the objectives are: 1 – not achievable; 2 – possibly achievable; 3 – likely achievable; 4 – most likely achievable; or 5 – certainly achievable.

Reviewer 21B-01 (Rating: 2)

First of all there is **no guarantee that the operations will be successful** and even if they are, it is hard to say whether they will be **indicative of the formation in general**. The proposer refers to the **results of their previous investigations without providing the sufficient details**, thus it is hard to say whether there is enough background data **justifying the approach** proposed. Moreover, the proposer intends to conduct only tests which **are normally conducted in oil and gas operations**. In a research project it could be useful to think of some tests which go beyond **standard practice**.

Reviewer 21B-02 (Rating: 5)

The objectives, while limited in scope, are almost certainly achievable. Failure to complete the limited goals would only occur in the event of a drilling problem preventing the completion of the subject wells, or some scheduling issue preventing the service company from simultaneously stimulating both wells, **or sale of Peak company prior to completion** of report. **These should be easily overcome, and can easily be included as criteria that NDIC payment will not be made unless successful completion of report**.

Reviewer 21B-03 (Rating: 4)

The approach, timeline, and budget readily support the achievement of the stated objectives.

Peak response:

While Peak has not provided any guarantees on the successful implementation of this operation, it must be noted that none of the previously proposed OGRC projects that Peak investigated which were eventually funded had guarantees for their success incorporated either. As such, it would be unfair to use this as criteria for evaluating Peak's proposal. Should this become an issue however, Peak agrees with the reviewer 02 response that an easy solution could be included that NDIC payment was contingent on the successful completion of this project. As stated in the first bullet point under Standards of Success (page 10) in the original application, Peak assumes 100% of the financial responsibility and mechanical risk of the drilling portion. This statement can easily be modified to include Peak assuming the financial and mechanical risk of successfully completing the simul-frac portion prior to obligating the NDIC to pay their agreed upon portion of this project.

In addition, should Peak be sold prior to the completion of this project (and therefore ***prior*** *to the NDIC being obligated to pay their agreed upon portion), then language can*

*also be added stating that Peak's successor would then have the choice to either continue with this project as planned or to keep all costs, and therefore all reporting and data obligations, in house. Should Peak be sold after completion of the project and **after** the NDIC has already paid their agreed upon funding portion, the successor would then be obligated to fulfill all terms of the agreement made by Peak.*

Whether results from this test are indicative of the formation in general was answered under section 1 and will ultimately be decided by individual operators after they have made comparisons of data here to their own areas of interest. Again, it must be stated that while Peak makes no claims this technology can be extrapolated for use across the entire basin, there are many hundreds of thousands of undeveloped acreage that can be conclusively proven to have very similar geologic characteristics using publicly available data sets. Peak is therefore confident that individual operators will also make use of this data in areas they operate if analysis indicates they have a similar reservoir to complete.

Peak's previously drilled wells in this area, along with other operator's recent results are all a matter of public record with regards to production results and at least the minimal required reporting data on frac types used. Peak has all the normal level of details for both production and frac data in house (and not currently in the public record) which will be used and referenced for comparison of results. It was impractical to include all this previous data as evidence of having sufficient detail within the confines of a 15 page application to justify undertaking this simul-frac. Peak will therefore stand on the body of evidence and arguments presented in the application for justification purposes. Peak will also stand on its past record of having successfully conducted this same operation in the past to prove that this approach, timeline, budget and objectives are indeed achievable as the grade should have indicated in this section.

Peak disagrees that we will only be conducting tests that are "normally conducted in oil and gas operations" currently being practiced in the Bakken. As of this writing, the entire simul-frac operation being proposed is not being normally used by any operator to our knowledge which is a primary reason for this grant proposal to the OGRC board. It is hoped that through the OGRC grant process this new technological approach to completions and lateral placement can be widely distributed to the other Bakken operators in this basin who will then make their own determinations on whether it warrants testing in their own areas of operations.

3. The quality of the methodology displayed in the proposal is: 1 – well below average; 2 – below average; 3 – average; 4 – above average; or 5 – well above average.

Reviewer 21B-01 (Rating: 2)

To my mind the **investments required** for this proposal are a **little too high** for the collection of the **sparse data**. Thus, even though there is no doubts that the proposed methodology is viable I grade it lower than average.

Reviewer 21B-02 (Rating: 2)

Again, the goals are relatively modest. The deliverables are **limited to a comparison of production through 90 days** and a **massive data dump** of treatment details on these and previous Peak wells. As discussed in Section C, the reviewer completely concurs that evaluation of production data is key to validate the impressions obtained from microseismic data from simulfracs. The reviewer agrees this study is merited. However, the goals and methodology could be improved to substantially increase the value of the study as discussed in Section C.

Reviewer 21B-03 (Rating: 4)

The applicants provided a well written, concise description of the proposed drilling and completion methodology. The means by which data will be statistically evaluated is not ultimately described in any substantial detail.

Peak response:

Peak regularly shares all of the data from drilling and completion operations with a small group of operators with whom Peak has entered into data sharing agreements and who have signed Confidentiality agreements. In return, these operators share like-kind data for which they have also spent nearly an equal amount of dollars acquiring during the course of their operations. Peak therefore believes that it is entirely reasonable to request a grant for $750K representing approximately 6% of Peak's total expected cost in this project in order to provide industry as a whole with the results of both this proposed test and the results of all Peak's previous completion attempts in this area for comparative purposes.

Defining the amount of data available as "sparse" is a subjective description since the existing data is what it is for these types of operations. If there were an abundance of available data already existing on simul-fracs and closer placement of laterals compared to more conventional frac and lateral placement techniques, there would no need for this study and subsequent grant request.

Finally, Peak has not proposed to merely provide a massive data dump in return for funding from the OGRC. The only reason Peak provided the 50 page frac report as an appendix in the original application (the likely reason for reviewer 02 describing the proposed end product as a data dump) was after a direct request from the examiner to provide an example of the type of detailed data not currently required for reporting to the NDIC after an argument was made that all this would eventually be made public anyway. The final report itself would be a much more concise comparison with Peak's conclusions drawn using the detailed well data (surface and BHL locations, lateral length and orientation, drilling and mudlog reports, etc), geological cross sections to tie all comparative wells together, actual production data with comparative charts, EUR calculations and tables outlining frac style stages and the differences between them. The same frac data detail provided in the grant application would be made available in an

appendix as part of the final report for those interested in the actual details from which all the conclusions and comparisons were drawn.

Also, while the initial final report would be required after 90 days of production in order to make a reasonable calculation for EUR for comparative purposes, the publicly available production runs (which list cumulative production for that month along with number of days producing) could easily be used for many years thereafter to make the same comparison for validating earlier EUR calculations. The intent of making this report available after 90 days was so that there was sufficient production data available to make the initial calculations for EUR's and therefore compare effectiveness of the different frac and lateral placement techniques. It could be made earlier but Peak believes that the commonly reported IP and very early production data alone is entirely unreliable for predicting EUR's. The report could also be made after 2 to 3 years of production history, which Peak believes is ultimately necessary before making accurate and final EUR calculations. It is, however, unreasonable to expect a 3 year delay in reporting results or to make either Peak or its successors responsible for assessing this data for a two to three year period when any entity interested in making this final comparison can easily do so using the before mentioned publicly available production data.

4. The educational contribution of the proposed work to specifically address North Dakota Industrial Commission/Oil and Gas Research Council goals will likely be: 1 – extremely small; 2 – small; 3 – significant; 4 – very significant; or 5 – extremely significant.

Reviewer 21B-01 (Rating: 3)

The proposed work addresses the NDIC and OGRC goals. However, I am **not sure** that the collected data will be **readily applicable to significant portions of the Bakken**.

Reviewer 21B-02 (Rating: 3)

It would indeed be nice to have a confirmatory test as to whether simulfracturing provides benefit. Unfortunately, the results of this trial **are unlikely to be definitive or immediately adopted by other operators** – as the **statistical significance of the results from 2 pairs of wells is fairly limited**.
From the application, it is apparent that Peak is pleased with the performance of their first attempt at simulfracturing, but it is unclear whether the **production improvement can be attributed to proppant selection, fluid alteration, local geology**, etc. A second test is absolutely merited by Peak, and it is stated that they will pursue with or without NDIC grant. However, if the next pair of wells is also good compared to historical Peak wells, it again **will not be certain** whether the increase is **due to luck, some combination of operational parameters** that have been changed (fluid, proppant, QC, drilling or completion nuances), **luck in geological position**, or whether it can be convincingly be

attributed to simulfracing. In Section C, the reviewer has made some suggestions that may be incorporated to identify the impact of some of these other parameters.

Reviewer 21B-03 (Rating: 4)

The applicants have proposed an effort that would put a spotlight on a drilling and completion program that is quite different than the bulk of current Bakken efforts. The effort proposed herein should provide key data toward evaluating reduced spacing and "short" lateral completions in an emerging area of the Bakken play.

The results may have applicability well beyond the immediate study area.

Peak response:

Again, reviewer 01's doubts about the applicability to larger portions of the basin have been answered in both sections 1 and 3 responses. At the very least, it is readily apparent that similar geological conditions exist over most of the +500,000 undeveloped acres contained within the Fort Berthold Indian Reservation where nearly 15 companies are currently active. This area currently contains NDIC approved mixed density drilling units that run from 320 acres to 2560 acres, each with a variable number of wells allowed and drilling window set backs from lease lines. It is hoped that exposure to this data will allow both the NDIC and operators to make more informed decisions when placing the initial wells and configuring future drilling plans on their leases so that enough room remains to properly place the inevitable future infill wells after primary drilling to hold leases has concluded. Peak also contends, as has been stated before, that this same comparison can be made using publicly available core data and OH wireline logs to a much larger area outside of the FBIR with enough similar evidence to warrant testing there as well.

Peak is aware of and completely agrees that the data set available after completion of this project is currently limited and therefore, the statistical significance of these results can be argued. It is not Peak's intention to declare that, should the results of this second test also be favorable, this technique should then be widely adopted as the definitive completion style in this geological setting nor would Peak expect industry to immediately adopt this technique for widespread operations. It is merely intended to promote additional experimentation by other operators and provide a spotlight on new technologies that may eventually be more widely adopted by industry in other areas if the results and local conditions merit using this approach. Again, if there were already multiple operators attempting these techniques with enough public data available for making statistically valid analyses, there would be no need for this grant request and subsequent disbursement of results to industry in the first place. This is not the case however and it has been often observed in the evolution of other similar non-conventional plays that early knowledge of successful innovations commonly sparks increased experimentation by operators until enough success has been achieved to make what was originally a new technology become an industry standard practice.

It must also be noted that the important details for most early, successful innovations by publicly held companies are usually held confidential and rarely, if ever, shared with industry as a whole. As a relevant example in the Bakken, EOG's reporting of early success with multiple stage fracturing sparked an industry wide frenzy with other operators trying to emulate those techniques and results. There is no doubt that many millions of dollars were spent basically re-inventing that particular wheel by nearly every operator since the details of those fracs (fluid properties, proppant selection, fracture gradients, pressures, communication between stages, any interference noted between new and existing wells, etc) were held completely confidential. In this case, Peak is offering full disclosure of both results and methodologies for industry to take and adapt or change parameters according to their own particular needs and operational areas without spending millions on trial and error in an attempt to replicate exactly what was done on this project.

5. The principal investigator's awareness of other current educational efforts being conducted by other persons or entities related to the proposal is: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.

Reviewer 21B-01 (Rating: 4)

The PI seems to be aware of the activities and approaches used in Bakken and in other similar formations.

Reviewer 21B-02 (Rating: 4)

Peak demonstrates good understanding of many issues with respect to completing and fracturing Bakken wells. Good explanation of need to "verify and validate" microseismic-derived interpretations with actual production data. They did not reference many other Bakken studies, but I am unsure it was necessary for this application. There were a few comments such as **accepting that high gel loading and Versaprop were responsible for their historic improvements**, without any acknowledgement of other studies by other operators that directly contradict these decisions.

Reviewer 21B-03 (Rating: 4)

The applicants have done their homework, and it is reflected in the proposal, with some relevant published material cited (but an inadequate citation provided for the Tudor Pickering Holt report [1/21/2010] precluded this reviewer from retrieving it).

Peak response:

Peak is not attempting to answer all the variables associated with various completion techniques with this project, including the type of gel loading used or the Versaprop vs Econoprop vs White Sand proppant questions. Peak simply intends to directly compare results of what was previously tried vs this different completion type and let the

individual operators decide if they would like to further experiment with the nearly infinite number of variables that can be introduced into individual stimulation designs.

It should be noted however that Peak's early results (which will be made available in this study) tried several different concentrations and types of proppant with various resultant production profiles. After conversations with a data trade partner and subsequent follow up using the IPT consultant group, Peak obtained information about crushing strength tests of several proppant types that was instrumental in the decision to eventually use the proppant type in these improved tests. This data was also used to correctly model production from those earlier wells since initial production had to be modeled with one permeability and later production with another which careful analysis clearly showed to be a crushing phenomenon. At least two of our data trade partners are now using this different frac design on individual short lateral wells and this data is essential for use in comparing the results of simul-fracs vs individual fracs in wells since all other parameters are essentially the same. Peak intends to present the crushing data and results from the data trade partners (after their permission is granted) as part of this comprehensive report if the grant process is successful.

6. The background of the investigator(s) as related to the proposed work is: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.

Reviewer 21B-01 (Rating: 3)

The qualification of the team seems to be sufficient for conducting the project. However, sometimes the **discussion in the proposal seems naïve** especially in the part where **assumptions of the data applicability to bigger area** within the formation are made. I believe the proposers have enough experience to know all the corresponding issues just did not feel that the discussion is appropriate in the proposal.

Reviewer 21B-02 (Rating: 3)

Peak demonstrates good background knowledge, and very good motivation and intellectual desire to improve. Their **relatively small number of wells** constrains the **statistical validity of conclusions** they reach. There are some comments in the application that bring the **technical judgment of the company into question**. (see details in Section C). For instance, **hiring IPT to conduct a DFIT analysis**, then **predicting production** from those results, then planning to **compare actual production to predicted to evaluate the success of simulfracing**... **Peak appears to have been oversold on the merits and statistical certainty of this technique** and/or the consultant's capabilities.

Reviewer 21B-03 (Rating: 5)

The project team is exceptionally well-qualified and the applicants have laid out a compelling proposal.

<u>Peak response:</u>

Reviewer 01's concerns about the applicability to a larger area have already been discussed in several of Peak's responses here which should therefore dispel the notion that Peak is naive in this regard. We strongly disagree that this data therefore cannot be extrapolated and ultimately used in a very large area of Bakken development.

Peak's response to reviewer 02's concerns about the relatively small number of wells available and statistical relevance of that data has been answered in detail under section 4 and elsewhere in this document. We certainly understand the nature of having enough data to make statistically valid conclusions and realize the current amount of data available falls short of this measure. Again, industry is sometimes forced to work with what is available, in this case, a very small number of initial tests and wells for comparison. The initial results however, do lead to some very intriguing possibilities for enhancing production, recovering a significantly higher amount of oil in place and leading towards closer spacing of laterals (as has been the evolution in many similar unconventional plays in the past). While conclusions are reached based on the available data, Peak makes no assertions whatsoever that these are complete as they stand and would very much encourage other companies to undergo additional testing and comparison so that eventually, a statistically valid data set does exist from which more concrete and far reaching conclusions can be drawn. Peak hopes that engaging in this grant request process directly leads to further exploration of these techniques thereby improving common industry practices as a whole in developing this resource.

Peak would like to clarify its position relative to the hiring of IPT since our technical judgment was called into question by reviewer 02. IPT was being used as a frac consultant and onsite quality control during operations by a data trade partner in the immediate area of Peak's earlier wells. Their resulting production profiles represented a substantial improvement over the production from the Peak wells with all the evidence pointing to IPT's design enhancements and changes to the process in the field as the primary contributor to those improved results. Peak therefore initiated conversations and subsequently hired IPT to both design and implement the completions in the field on our next set of wells, two of which were the original simul-frac pair. The resulting production indicated an improvement of 30% or more reserves being recovered per lateral. Peak absolutely did NOT hire IPT to run a DFIT test, predict production then compare actual to predicted results as a means of evaluating the success of a simul-frac as stated by the reviewer….this is simply not true. Peak management has cumulated many years of experience with reservoir modeling and is fully aware of how many "knobs" a modeler can tweak to affect results. We therefore place very little weight on determinations of effectiveness based purely on modeling results but rather use them as a

tool for estimating results while designing various completion types. Peak's primary means of determining the effectiveness of various stimulation designs is by directly measuring production and subsequent EUR's vs the cost to increase those reserves in order to determine the best economic outcome and most efficient design. This is exactly how Peak stated its intent to measure deliverables on this proposed project. IPT's DFIT analysis is only a small part of the overall project and was used primarily as a very early indicator of possible perm on only the first stage of a multi-stage completion process along with being a parameter entered into their frac modeling process. The primary reason this was even mentioned at all was at the examiners request, after reviewing the initial grant proposal submitted, to list any additional testing methods Peak was going to employ above and beyond what was considered standard industry practice (like micro-seismic monitoring, production logging, frac tracing, etc). Other reviewer 02 comments regarding Peak's technical judgment in Section C will be answered individually there.

7. The project management plan, including a well-defined milestone chart, schedule, financial plan, and plan for communications among the parties involved in the project . is: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – very good; or 5 – exceptionally good.

Reviewer 21B-01 (Rating: 4)

The proposed schedule and milestones seem to be well chosen and realistic.

Reviewer 21B-02 (Rating: 3)

Again, the **goals and deliverables for this study are extremely simple**. Peak knows how to drill and complete wells. The only "incremental" work that will be conducted in exchange for this grant is to transmit data to the NDIC, and write a summary of findings. As such, the management plan is entirely adequate but largely irrelevant. It seems unfair to not give them a 5 on this category, however, the applicant receives unearned 5 ratings on the next two categories (Facilities and Equipment) – so it works out.

Reviewer 21B-03 (Rating: 4)

Top notch milestone chart, schedule, etc.

Peak response:

Peak respectfully disagrees that the goals and deliverables on this study are extremely simple as this project is both technically challenging and difficult to implement with Peak incurring all of the financial risk if unsuccessful.

8. The proposed materials and media to be developed or used are: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – very good; or 5 – exceptionally good.

Reviewer 21B-01 (Rating: 5)

No equipment to be purchased.

Reviewer 21B-02 (Rating: 5)

No equipment is to be purchased

Reviewer 21B-03 (Rating: 5)

It is not entirely apparent if any equipment is to be purchased, but even if equipment is to be purchased, it likely represents an excellent value.

9. The materials and media available and to be purchased for the proposed educational effort are: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – notably good; or 5 – exceptionally good.

Reviewer 21B-01 (Rating: 3)

The proposer intends to use up to date equipment and facilities.

Reviewer 21B-02 (Rating: 5)

Of course, typical facilities are required for all Bakken development. However, no incremental equipment or facilities are required to investigate simulfracs. (Unless the pad size was increased to accommodate additional water tanks or pumping equipment) But no facilities are described.

Reviewer 21B-03 (Rating: 5)

The drilling and completion program that will be conducted afford an excellent opportunity to conduct the effort.

10. The proposed budget value relative to the outlined work and the financial commitment from other sources is of: 1 – very low value; 2 – low value; 3 – average value; 4 – high value; or 5 – very high value. (See below)

Reviewer 21B-01 (Rating: 5)

The proposer's cost share is more than 93% of the total project cost.

Reviewer 21B-02 (Rating: 1)

The operator has not disclosed the incremental cost to implement a simul-frac. My previous experience suggests that this **incremental cost is very small or even zero** in some other fields. My impression is that Peak will pursue this investigation regardless, and that **NDIC is being requested predominantly to subsidize the reporting and release of data.** However, **$750,000 seems to be an exorbitant amount of money** to pay, **when the operator incurs very little cost to compile the information**. This is more a question of whether the NDIC believes the public disclosure of the data will justify the $750,000 payment.

Some of the **benefits claimed by Peak seem exaggerated** as described in Section C of this document. Instead of a **data dump of "$60 million" of data** – the test could be reformulated to directly compare some operational elements and provide a well-structured report that will be shared both the NDIC and perhaps published in SPE or other forum to further improve data dissemination and adoption**. Honestly, I do not believe providing frac QC reports on a hundred frac stages will provide the kind of value that is claimed**, as most offset **operators will not have time to review/compile/interpret** and then determine how that related to cumulative production from a composite well.

Reviewer 21B-03 (Rating: 5)

The total project cost relative to the OGRC cost provides excellent leverage.

[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.

Peak response:

Peak fully answered reviewer 02's concerns about the value of this request and on the characterization of this proposal as simply a data dump rather than a concise and readable report in several of its previous responses here, specifically addressing many of these issues in Section 3 above. Peak disagrees with the statement that we incur very little cost to undertake these tests and has spent many millions of dollars already experimenting with frac design, lateral placement, spacing issues and other forward thinking enhancements trying to understand what ultimate development of this important resource may eventually look like. We do this based on our cumulative decades of previous management experience in emergent unconventional plays with a full and complete understanding of how slowly they typically develop. We have personally been involved in the early development processes of such outstanding resource plays as the San Juan Basin Fruitland Coal, the Panhandle Granite Wash and the Barnett Shale plays where we actively participated, watched and learned as industry eventually came to normalize spacing and completion optimization in order to maximize economic recoveries in those world class reservoirs. Peak has a long history of data sharing with

like minded operators where we all benefit from each company's technical advances in both drilling and completion designs and have been continuing to do so here with a small group of operators. Peak views this OGRC process as a means to also more widely disburse this information to a large group of active operators thereby significantly speeding up the learning process for many of them who will undoubtedly benefit from and be able to immediately use this knowledge. Peak is also a business with a responsibility to make a profit and manage expenses for both our financial partners and our mineral owners. As such, with our data trading partners, if we spend money to acquire data on two wells, they then trade us like-kind data on two of their wells where an equal amount of money was spent to "acquire" that data. It is therefore entirely unrealistic to expect Peak to simply share this hard earned and expensive knowledge with industry as a whole without any monetary incentive exactly as it would be unrealistic for anyone to expect EOG, Continental, Whiting, Brigham, and every other company to voluntarily share details and conclusions of their drilling and completion practices even though every industry participant would certainly benefit from this exchange. Again, Peak therefore thinks it is entirely reasonable to request this grant, which represents ~6% of the total costs for this project and only a small fraction of the money Peak has spent to date, as incentive for compiling and publishing the various data and conclusions from our past +2 years of activity here. Peak believes that this study is completely aligned with OGRC's stated goals and objectives of developing information that leads to other projects, processes, ideas and practices, the identification of new technologies currently not being used in ND, and improving ultimate recovery from a world class reservoir as is more fully explained in the original application. We leave it up to the OGRC Council to determine what value dissemination of this data will have.

<u>Financial commitment from other sources</u> – 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.

Section C. Overall Comments and Recommendations:

Reviewer 21B-01

It might be useful to request the proposer to provide some justification of the applicability of the results to significant parts of Bakken. Also it should be realized that the results of the proposed project can indicate that the assumption on the optimum spacing is incorrect as only one field trial has been successful so far.

Peak response:

Peak has discussed several times in the above responses its belief in the potential for this application to cover significant portions of this basin and believes that many of the other operators will also see this same potential. Peak also has discussed the limits and benefits available from this initial and limited data set. Peak would like to point out that after conclusion of this project, there will be two field trials on ~1320 spacing between wells, one 640 acre tract where Peak currently has Middle Bakken wells (2640' apart) and one Three Forks well between them (1320' from each MB well), along with several non-operated offsets effectively constituting 320 acre spacing and less to our earlier program. There are therefore several successful field trials in this immediate vicinity to date. There are also several other pertinent tests outside of the FBIR regarding spacing and interference including Continental and others testing stacked laterals in TF and MB wells, EOG drilling a 320 spaced 2008 infill well in the Parshall unit, the Marathon OGRC project (G-015-029) using microseismic to test potential interference in simul-frac wells, the Bakken Research Consortium project (G-015-029) using microseismic to monitor frac growth in two laterals along with numerous recent applications by industry proposing 2 to 4 MB laterals per drilling unit with subsequent permits coming out for those areas weekly. Peak proposes that the data from this project along with its previously collected data on well spacing will be an important data point for the larger set of spacing data that is currently emerging in this basin.

Reviewer 21B-02

Clearly, the total cost to drill two wells is extremely large, exceeding $10 million, and estimated at $11,450,618. If that is used as the basis, the $750,000 requested funding is very small or 6.5%. Completion costs alone are over $1.5 mm. However, what is not established or disclosed is the ***incremental*** cost to simulfrac two wells and prepare appropriate documentation. In the reviewer's opinion, this will be less than $50,000, and likely less than $20,000. Viewed in this manner, the requested $750,000 dramatically exceeds the operator's incremental cost.

Peak response:

Peak fully answered these concerns specifically in responses under sections 3 and 10 above.

Other comments on Peak application:

Page 3, Abstract: It is not clear whether "interference" refers to pressure anomalies at offsite wells as a direct effect of pumping an adjacent frac, or whether "interference" refers to detrimental competition and observable production loss as a consequence from offset well production.

There were no offset horizontal wells within several miles of the original two simul-frac wells at the time of their completion. In this instance, the first stage (at the toe) of one well was frac'd individually with no pressure bumps recorded in the open toe of the second well. Stages 2 through 7 on well one and stages 1 through 6 on well two were then simul-frac'd. Then, the last stage (at the heel) of the second well was frac'd individually with no pressure anomalies recorded from the first well. Additionally, subsequent production seems to indicate that neither well is in pressure communication or suffering from detrimental competition at this time.

Page 3, Objectives. Operator likely means "production decline" not "pressure decline"? Or are you pinching wells back to some extent prior to running pumping units?

The operator actually did mean to say pressure decline. One of the most telling components to determining how effective these fracs are is looking at the rate of pressure decline (along with production decline). It was noted early on that the wells completed by our data sharing partner took much, much longer to drop in producing pressures (and therefore went for months longer before the need to put on pump for lifting fluids) indicating that their fracs effectively communicated to a much larger portion of the reservoir (or that their fracs were more effectively propped open and stayed that way). As a direct result, their wells also produced significantly more oil which makes sense as the reservoir was more slowly pressure depleted. This was a primary reason Peak began investigating the IPT designed frac and quality control applications during the stimulation process in the field.

Page 4: Instead of merely providing "data" on well placement, lateral orientation, and timing of completion – Peak should commit to summarizing their interpretation in addition to providing all data for critical review by other operators.

As discussed in previous responses, Peak never intended to merely provide a big data dump and let the readers draw their own conclusions but rather to summarize results and our interpreted conclusions in an easily readable report. The associated "data" will be provided in an appendix for so that other operators can see where the conclusions were derived from if they so desired. Also, while the details in these reports are way too much information for some people, experience tells us that there are many technical staff at these companies who have a real need to see this intense level of detail in all reports.

Page 4: While I agree the TPH report suggests 3 month cums are proportional to EUR – this is not proven to hold for simulfracturing. Some have suggested that simulfracturing may result in a greater degree of rate acceleration, as compared to drilling longer laterals,

selecting better proppant, better location, or other effects that influenced TPH evaluation. If possible, NDIC or other agency should commit to revisiting the trends after extended production (say 2 years).

Peak agrees here as stated in more detail under our response to section 3. The entire purpose of sending a report after 90 days is that this is the MINIMUM time required in our opinion to make an estimate of EUR and only then if there are wells in the same geologic area with long term production (1 year or more) from which to derive decline curves for matching. Ultimately, it will take several years in these tight reservoirs to finally determine effective drainage, true EUR's and incremental vs primary recovery issues on closely spaced wells.

Page 5: dramatic improvement in "pressure" decline curves? What pressure data are gathered on these pumping wells to document this? How will similar data be provided for upcoming wells? Is Peak merely referring to surface pressure declines over first 45 days prior to running pumps, or is there some bottomhole pressure data they refer to?

Similar to the previous response above, Peak is discussing the observation of producing pressure decline curves prior to installing pumping units which present compelling evidence as to the effectiveness of a frac and how much reservoir has been connected.

Page 6: Will this actually be a "zipper frac" instead of a simulfrac? If Peak desires to "monitor pressures in each wellbore" to observe communication from adjacent well, perhaps what Peak meant to describe was to fracture stage 1 in well 1 (while well 2 is stagnant and monitored), then switch to well 2, stage 1 while well 1 is stagnant and monitored. This is commonly called a zipper frac. A simulfrac requires simultaneous pumping into both wells, and very minimal information is available as to possible pressure interaction between wellbores. With the discussion of pressure monitoring, I am questioning whether Peak actually intends simul or zipper fracturing.

This is a great question. Peak is contemplating both techniques here which are similar in their intentions. Both frac styles should have practically the same effect with the frac wings from one well being influenced by rock already pressured up and retaining that pressure (and the subsequent theoretical diversion of the offset frac wing) from the other well. In this particular case, Peak is considering the "zipper frac" mentioned above where stages in each parallel well are frac'd alternately (rather than simultaneously). The reason both are being contemplated is that there is currently a severe availability limit on frac crews and the simul-frac requires two crews, one for each well, with the zipper frac needing only one crew on location. If Peak cannot get our service company to commit two crews to this job, we will then zipper frac both wells.

Page 8: While the operator has made a logical explanation as to why they progressed from sand+Econoprop to 100% Versaprop, they have not apparently identified how 100% Econoprop would compare to 100% Versaprop. This is a controversial topic in the literature and in industry, with several Bakken operators reporting better success with

Econoprop and Peak reporting better success with Versaprop. The value of this trial would be dramatically improved if several incremental studies were included in this trial:

- If we presume each well has 8 stages, consider the following staging:
  - Well 1, stages 1,2 5,6 Versaprop
  - Well 1, stages 3,4 7,8 16/20 ISP or other proppant Peak wishes to investigate
  - Well 2, stages 3,4 7,8 Versaprop
  - Well 2, stages 1,2 5,6 16/20 ISP or other proppant Peak wishes to investigate
- Production logging of both wells would be required to evaluate the relative productivity of each proppant type.

Having two wells in such close proximity and having a carefully structured alternating proppant selection would provide a good way to compare productivity. Alternatively, if Peak wished to investigate other operational procedures (proppant concentration, size of each stage, effect of 40 lb gels instead of 24 lb, etc) that could be substituted and provide much more useful information to other operators.

One of the severe limitations to the Peak proposal is the limited statistical validity of a pair of wells. By production logging each stage, the number of measurements can be increased to ~20 instead of 2.

Peak does not intend this project to also test the myriad possibilities of various frac designs and proppant but rather to compare what was done with this single type of frac style and proppant where we have sufficient data to make a decent comparison between simul-frac wells and individually frac'd wells. As discussed in a response to section 5 above, we will make available some very key data regarding crush tests undertaken by an independent laboratory showing that many of the commonly used proppants in this field undergo catastrophic crushing on the third pressure cycle with the proppant Peak is currently using significantly outperforming the others. This data was initially shown to Peak by IPT while they were explaining the great difficulty they were having modeling our existing production which could only done by changing the effective permeability and effective prop length part way along the production cycle. The change in these two key parameters could easily be explained by crushing phenomenon, hence the lab tests. Peak intends to include most of this data in the final report.

The reviewer recognizes that production logging is expensive and not 100% reliable in horizontal wells. However, for $750,000 funding from NDIC, Peak should commit to providing further information, or find some way to increase statistical merit of the study. If Peak is uninterested in running a production log, perhaps one of the pair of wells would be treated with a different strategy (higher proppant concentration, etc) to determine the relative performance of adjacent wells, in addition to simulfracs strategy.

Peak has had numerous experiences with production logging in both vertical and horizontal wells the latter of which in particular, present difficult interpretation problems and agrees that not only are they very expensive and prone to mechanical failures (along with losing equipment down hole thereby causing even more expense in fishing jobs) but also not 100% reliable and subject to multiple interpretations from the same data. Peak

will therefore not consider production logging as a viable evaluative tool on this project. In addition, Peak already has sufficient data (as much that currently exists in a newly emergent play for this area) on various proppant concentrations and types along with fluid changes in conjunction with individually completed wells with nearly identical stimulation designs with which to compare the simul-frac results as stated in the original application. Peak is now interested in repeating the success in our last two simul-frac wells and not prepared to risk production in these next two by conducting unnecessary science testing.

Page 11: In my opinion, IPT "predicting" performance based on DFITs – and then evaluating benefit from SimulFrac compared to DFIT predictions is a dubious approach at best. In my experience, there is erratic correlation between DFIT and EUR in the Bakken. Operator should provide their DFIT&EUR data on previous wells if they wish to suggest this will be a valid correlation technique.

Peak has already discussed this topic in great detail under our response in section 6 above.

Page 11: The NDIC would indeed benefit if it could be proven that 160 acre spacing recovers additional reserves (not just accelerated production). However, it is unclear how the Peak proposal will reach that conclusion with only 3 months of initial production data analyzed. Are you relying totally on TPH report concluding that in general 30 day IPs are correlated with EUR? If so, that is totally inappropriate, and a misuse of TPH's analyses and limitations of their study. It is also unclear to the reviewer that the conclusions can truly be applied to ANY laterals on 1320' spacing as the application claims. Won't wellbore and fracture orientation affect the degree of interference/diversion/benefit? Won't directional permeability affect competition of offset wellbores differently if they are oriented differently or if perm anisotropy varies across field?

Peak has already discussed this topic in great detail under our responses above.

Page 13: Again, concern with just having flowing pressures. Since these wells will likely be pumped after 45 days, some understanding of "how hard" each of these wells is pumped and comparison to offset production practices will be necessary. Clearly, wells can be pumped aggressively or conservatively, affecting short term production. Again, reviewer would suggest some sort of followup analyses at 18 months and 36 months, but concede that it may not be possible to obligate Peak to that duration of commitment in the fast-moving world of Bakken ownership!

Peak has already discussed this topic in great detail under our responses above.

Page 14: for information dissemination, might suggest Peak publish an SPE paper in addition to simply releasing to NDIC?

If this is made a requirement of the grant request, Peak will consider that before committing to the project.

Page 19: Although Form 6 does not require disclosure of number of stages, fluid type, proppant type, etc most operators have already disclosed this as routine submission. Reviewer did not investigate the extent of Peak's historic disclosures.

Peak has discussed this above as well. In our experience, the kind of data routinely submitted lacks all the important details needed to differentiate between frac techniques. Number of stages, proppant and fluid amounts, etc are very generic and do not have any data on pressures (specifically the pressure profile during the frac process which is a key evaluative tool when determining effectiveness of placement and interference between stages among other things) along with any details on fluid properties which are critically important to understand. If the kind of data already submitted to the NDIC were sufficient to design fracs, then companies like EOG would not be so reluctant to share this information with other operators when requested.

Page 38: The vast majority of the On-Site stimulation report will provide minimal benefit to other operators, who will not have time or interest to correlate/review on-site QC bin volumes, additive pump calibrations, etc for the hundreds of stages that Peak may be able to provide from their historical wells and those of willing offset operators in FBIR. What would be more useful to other operators is a careful evaluation of whether fluid selection or proppant type or some other specific parameter indeed helped as Peak claimed. [Ie, how much of the benefit Peak observed previously is repeatable? How much was due to switching from sand to Versaprop? How much from 24 lb to 40 lb gel?] Honestly, I do not anticipate the "database dump" will be adequately digested by the NDIC or the industry, and do not believe it provides the $60 million dollars of benefit described on page 14.

Again, Peak has more thoroughly addressed these concerns in previous responses above on "data dumping" and the huge amount of detail that will be in the appendixes rather than the main report. The $60 million dollars mentioned was not to say this project represents a $60 million dollar benefit as suggested by the reviewer, but rather to point out that Peak has already invested a significant amount of dollars into drilling and completion data and is willing to share that with the NDIC through this process as discussed previously.

Page 49: It is interesting that all DFIT parameters are calculated assuming a single planar fracture. This does not seem to agree with any of the fracture mapping conducted in the Bakken, and it is somewhat in contradiction to the entire concept of simulfracing. Granted, this is a single, small proppantless injection, so perhaps the geometry is more simple. However, it is claimed that evaluation of this DFIT can give an acceptable baseline from which to determine success of subsequent simulfracs? If Peak has a good dataset showing that on their wells, DFIT interpretation completed PRIOR to seeing well production are consistently correlated to actual EUR, this must be supplied prior to

receiving funding for this technique to be used as a component of the evaluation of simulfrac success/failure.

Peak discussed our opinion and use of the DFIT data in detail under our responses above. As to the single planar frac wing used in the modeling, this is merely a simplified way to enter data into a model in order to reduce variables for history matching the production and commonly used by industry. Both Peak and IPT understand that actual frac plane geometry is extremely complicated (and needs to be so in order to connect up with as much rock surface as possible) but modeling that is very difficult, time consuming and way beyond the scope of intentions for our use of the DFIT data. Also, even the most complex models ever built which incorporate multiple complex fracture formation, are in the end, just another model to match production histories that can be manipulated to get whatever results by changing perm, porosity, net h and any other number of variables that really exist in the actual reservoir and are therefore much more unreliable as indicators of frac effectiveness than actual production data is.

Overall: The reviewer agrees that simulfracs are worthwhile investigating, and if the reviewer worked for Peak, would also pursue a similar strategy as they have outlined. However, this work will be pursued with or without NDIC funding. In order to qualify for NDIC grants, the operator should make incremental investments (such as production logging, or flowing stages individually, or investigating different operational changes) that allow investigation of more elements and data from 18-20 stages instead of merely two composite wells (to increase statistical validity). Absent those incremental investments, NDIC must evaluate whether it wishes to simply purchase existing data from operators in order to investigate what appears to be "best practices". That becomes a very difficult process – do you simply find the operator who appears to be making the best wells and offer to "purchase" full disclosure of their strategies?

The reviewer would suggest that Peak modify the application to increase datagathering by stage (production logs or individual stage flowback) and that the NDIC plan to subsidize some portion of those incremental costs. Absent that, $750,000 seems a very high ransom to pay for the existing Peak data, and there are likely other proposed projects that would more effectively be incented with these funds.

The operator explains that they will do the simulfracs regardless of NDIC funding. The incremental cost to the operator to share the data with NDIC is small. If as a reviewer, I were asked whether I would pay $750,000 to "purchase" Peak's data, I would say no. This program is generally established to encourage experimentation and evaluation that would perhaps not be cost-effective without subsidy. Not to purchase data that are unlikely to be statistically compelling as to the merit of simulfracturing.

If the goal were simply to investigate simulfracturing, clearly the State could pay an operator less than $750,000 to alter development plans and attempt simulfracs on more than a single pair of wells. So this does not appear to be a cost-effective way to collect those data. [Perhaps the State could give $150,000 to five different operators if they each attempted a simulfrac and reported the results. This would yield improved statistical

certainty, encourage operators to try new things, and result in superior data dissemination than the received proposal]

Again, I do think the proposed research is valid and helpful, and I completely agree with Peak's plans to examine it. However, if there are multiple proposals that NDIC is evaluating, I may suggest that Peak's request for $750,000 is far too aggressive, and a much lower amount may be appropriate to "buy" their results for dissemination, if that meets NDIC's strategy to purchase "best practices". On the other hand, if some of the other improvements suggested in Part C can be incorporated to increase the utility of the gathered data, that would be helpful, and the grant size increased commensurately.

Reviewer 21B-03

In general, this is a well written proposal that clearly outlines its objectives, approach, methodology, and attendant schedule/budget. This reviewer recommends funding the project.

If there is a weakness, it lies in the tech transfer arena. This reviewer encourages the OGRC to mandate that the applicants agree to present at upcoming Williston Basin events (i.e. NDPC annual meeting or Williston Basin Conference) as a condition of funding. The OGRC might also consider encouraging the applicants to engage in collaborative efforts with relevant Bakken research projects that are currently underway.

A more general point of consideration for the OGRC could be the OGRC's priorities when evaluating projects such as this, which may provide key insight in a timely manner, <u>but</u> which also would likely do so in due time merely through the submission of required reports to the NDIC.