

TECHNICAL REVIEWERS' RATING SUMMARY

G-019-C

**Remote Monitoring and Reporting of Conditions
for Salt Water Injection Sites**

Submitted by: Pedigree Technologies

Principal Investigator: Will Shulstad

Request for \$25,350; Total Project Costs: \$50,862

Duration: 39 months

Rating Category	Weighting Factor	Technical Reviewer			Average Weighted Score
		<u>19C-03</u>	<u>19C-05</u>	<u>19C-04</u>	
Objective	9	5	4	3	36.0
Achievability	9	5	4	4	39.0
Methodology	7	5	3	3	25.7
Contribution	7	4	3	3	23.3
Awareness	5	4	3	3	16.7
Background	5	4	4	4	20.0
Project Management	2	5	4	4	8.7
Equipment Purchase	2	5	4	3	8.0
Facilities	2	5	4	3	8.0
Budget	2	5	4	4	8.7
Average Weighted Score		233	181	168	194.1
Maximum Weighted Score		250	250	250	250

OVERALL RECOMMENDATION

FUND	X	X	
FUNDING TO BE CONSIDERED			X
DO NOT FUND			

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 19C-03 (Rating:5)

The proposed project is consistent with OGRC goals 1-4.

It will make EOR and SWD injection operations more economic and efficient as well as providing improved environmental oversight.

By improving economic efficiency more EOR projects should be initiated creating jobs and increased oil recovery.

By improving economic efficiency stability, growth, and opportunity in the oil and gas industry should be increased.

This project will encourage, and promote the use of new technologies and ideas that will have a positive economic and environmental impact on oil and gas exploration, development, and production in North Dakota.

Reviewer 19C-05 (Rating: 4)

It is very clear that the project has potential to help reduce environmental impacts of oil production. Also clear that it may reduce labor for data collection and ease/simplify the effort to comply with reporting requirements.

Reviewer 19C-04 (Rating: 3)

The project proposal tries to connect with the goals of the Council. Clearly this type of technology will have a positive effect on both environmental and regulatory concerns with a bonus of reducing costs and data entry error. As far as attracting new firms and creating jobs, a firm may not move to North Dakota because we allow electronic reporting, rather it would bolster our reputation for ease of doing business here, which would be a net gain. In addition, this technology extends the oil and gas industry into another region within our fine state.

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 19C-03 (Rating: 5)

The Gant chart and budget are detailed and clearly lay out the tasks required and costs to complete the project.

Reviewer 19C-05 (Rating: 4)

I think the concept is sound. The greatest potential downfall may be reliability problems and downtime caused by equipment failure in harsh field conditions.

Reviewer 19C-04 (Rating: 4)

This is not extremely new technology, as remote sensing is already provided by firms such as Lufkin's IWC. Daily injection rates are commonly stored in electronic form such as production databases, where the data is either accumulated by hand, SCADA, etc. The software development and reporting are the most risk but as they seem to be adaptations of current technology the time and budget seems reasonable. However, I do not see in budget such items as travel, etc. (pg 15)

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 19C-03 (Rating: 5)

The design, installation, and lengthy testing process are in logical order and will maximize the information gathered as well as the probability of success.

Reviewer 19C-05 (Rating: 3)

No comment.

Reviewer 19C-04 (Rating: 3)

The methodology seems a bit flawed, while there is much verbiage around “leak” detection, while the actual injection plant volumes not considered. How does one know the totals? There is little discussion around calibration of the current flow meters, which incorrectly assumes those volumes are correct. Also, there is not a detailed testing plan as a part of the project plan (pg 8). Also little mention is made to data aggregation, the size of the database, and other data management issues (like security) or data interpretation such as Hall plots.

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: 1 – extremely small; 2 – small; 3 – significant; 4 – very significant; or 5 – extremely significant.*

Reviewer 19C-03 (Rating: 4)

The science to do this work already exists, but the adaptation of technology now in use by retailers to the oilfield environment will vastly improve the economic efficiency and environmental compliance of enhanced oil recovery and salt water disposal for both operators and regulators.

Reviewer 19C-05 (Rating: 3)

No comment.

Reviewer 19C-04 (Rating: 3)

The technical contribution will allow operators to reduce cost, while carefully monitoring both the surface and subsurface flow rates and pressure thus adhering to state laws, reservoir management principals and standard HS&E practices.

5. *The principal investigator’s 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: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.*

Reviewer 19C-03 (Rating: 4)

The principle investigator has demonstrated in the project proposal their research into current methods of monitoring EOR and SWD projects as well as the environmental effects of undetected leaks or spills.

Reviewer 19C-05 (Rating: 3)

No comment.

Reviewer 19C-04 (Rating: 3)

As I see flaws in the logic and the lack of awareness of products already in the marketplace, I would not rate the PI's awareness particularly high in regards to fluid injection. For instance, basic concepts are misstated (pg 3) "further strengthening the commitment of efforts around salt spill". More examination of the subject of subsurface fluid disposal should be undertaken. The accuracy of the fluid measurement is just as important as the data aggregation and reporting.

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 19C-03 (Rating: 4)

The principle investigator is very experienced in the field of remote monitoring technology. The operator of the waterflood where the technology is to be deployed and tested is very capable.

Reviewer 19C-05 (Rating: 4)

It appears that the investigator (Pedigree Technologies, LLC) has good experience in the technical field of remote sensing.

Reviewer 19C-04 (Rating: 4)

Via the proposal (pg 11), the investigator has significant experience to act in a prudent manner.

7. *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: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – very good; or 5 – exceptionally good.*

Reviewer 19C-03 (Rating: 5)

All of the required management plan segments are present in the project proposal.

Reviewer 19C-05 (Rating: 4)

No comment.

Reviewer 19C-04 (Rating: 4)

As evidenced by information in pages 12 and 13, the project management plan is very good. However, risks that could cull a timely delivery are not mentioned (such as software development issues).

8. *The proposed purchase of equipment is: 1 – extremely poorly justified; 2 – poorly justified; 3 – justified; 4 – well justified; or 5 – extremely well justified. (Circle 5 if no equipment is to be purchased.)*

Reviewer 19C-03 (Rating: 5)

Task 2 of the project provides a thorough listing of the equipment needs and justification.

Reviewer 19C-05 (Rating: 4)

No comment.

Reviewer 19C-04 (Rating: 3)

As the accuracy of the current flow meters has not been questioned, I think additional costs for calibration of existing meters, and the contingency of purchase of new flow meters is warranted. Based on this reviewer's experience, the proposed equipment purchase is justified.

9. *The facilities and equipment available and to be purchased for the proposed research are: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – notably good; or 5 – exceptionally good.*

Reviewer 19C-03 (Rating: 5)

Task 2 of the project provides a thorough listing of the equipment needs and justification.

Reviewer 19C-05 (Rating: 4)

No comment

Reviewer 19C-04 (Rating: 3)

Upon review the equipment appears adequate for the task. It is worth noting that the online price for the 232M2AOLE data acquisition unit is 21% lower (\$150; (<http://www.integrityusa.com/daqitemw.asp?record=43>), then the price indicated in Appendix 10.1.2 (\$182), indicating an opportunity to reduce costs.

10. *The proposed budget “value”¹ 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 19C-03 (Rating: 5)

Currently the State performs 4,000 inspections over the course of a year at over 560 locations. On average, this requires about 10 minutes each to record data and an injection site and 20 minutes in travel time. This travel time could be significantly reduced or eliminated using the remote monitoring capabilities of the proposed system. Operators also spend a significant amount of manpower monitoring these sites, much of which could be reduced by the proposed system. Most significantly, costs currently expended on remediation would be reduced.

Reviewer 19C-05 (Rating: 4)

No comment.

Reviewer 19C-04 (Rating: 4)

The overall costs are in line for what I would expect for this type of project. I see one major risk: the cost of software and report development seems low as 18% of said software development costs are attributed to project management, which seems high.

Section C. Overall Comments and Recommendations:

Please comment in a general way about the merits and flaws of the proposed project and make a recommendation whether or not to fund.

Reviewer 19C-03 (FUND)

Current monitoring practices at injection sites are subject to errors and are labor intensive for both the business operating the site as well as the State of North Dakota. A successful project will create the technology to reduce the error rate and labor costs of all EOR and SWD projects in the state.

Project success relies upon cell phone technology and reliability. Data integrity and security must be maintained with users accessing the data from anywhere over the Internet using a standard web interface..

Reviewer 19C-05 (FUND)

If successful this technology would also be applicable to monitoring flow lines. In recent years there have been more and greater impacts from flow line leaks than from injection well leaks. My recommendation is to fund this proposal.

Reviewer 19C-04 (FUNDING MAY BE CONSIDERED)

The existence of remote sensing technology for injection wells is established. What is not established is a more cost effective means to accomplish the needed level of automation. In terms of success, the proposal puts forth that further automation will grant additional efficiencies for both the operator and the State of North Dakota. At conflict is the goal to create jobs, this sort of automation would alleviate the need for lesser educated field staff thereby reducing jobs in that sector while requiring more instrument and computer/communication support specialists, which are in short supply. In addition, while on the surface, automatic reports sounds nice, but as with all engineering data, there should be oversight on the data being created. The proposal does not mention of the QA/QC of the data prior to publishing to internal, State or Federal groups. Workflow and usability analysis would be helpful to this technologies success. In addition, allowing government direct access to streaming data creates, in this author's mind, too far of a reach into a firm's business. In addition data ownership and management is not addressed, after the data is submitted to the data aggregator and distributor, who now has ownership of the data? Technically, the data host should also be collecting plant injection data to make sure the volumes are correct across the field from a material balance point of view.

What makes this sort of technology successful is if it is used in a complimentary fashion where engineering and field staff can use the technology to observe and intervene if necessary to preserve the environment and eliminate waste. An added bonus is that from HS&E perspective, this type of technology reduces road time and equipment contact time for field people, thus increases their safety.

I would recommend that the Council consider funding this project.