

Technical Reviewers' Rating Summary

Proposal Number Application Title Submitted By
 Request For Total Project Costs

Section A. Scoring

Statement	Weighting Factor	G-44-02A	G-44-02B	G-44-02C	Average Weighted Score
1. Objectives	9	4	5	3	36
2. Achievability	7	4	5	2	21
3. Methodology	8	4	5	4	32
4. Contribution	8	5	5	3	32
5. Awareness / Background	5	3	4	3	15
6. Project Management	3	3	3	2	6
7. Equipment / Facilities	2	3	4	3	6
8. Value / Industry - Budget	4	4	5	2	12
9. Financial Match - Budget	4	3	4	3	12
Average Weighted Score		194	233	144	190

Total: 50

250 possible points

OVERALL RECOMMENDATION

FUND **X** **X**
 FUNDING TO BE CONSIDERED **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:

The project is clear and the research done here could be a great asset to the industry and the the State.

- Reviewer: G-44-02A
- Rating: 4

The objectives are clearly spelled out.

- Reviewer: G-44-02B
- Rating: 5

Is 70 to 80% of chloride and sodium reduction from soil in contaminated source zone acceptable closure limits for the agencies overseeing remediation efforts? If not, then what are the acceptable closure limits and are they achievable in this proposal? Prior to remediation, targets should be evaluated prior to granting funding. Thoughts?

- Reviewer: G-44-02C
- Rating: 3

This EK method is a mass removal process at the contaminant source and is limited at this time to about 70-80% removal efficiency. The dig and haul method typically performs about the same but is not practical or cost effective at the proposed site (and many others). Chloride does not degrade, volatilize or change state over time. Other than removal, the only means of attenuation of chloride is dilution as it moves through an aquifer. Since there is no immediate human health threat from the release, the numerical standards may be relaxed in order to accomplish major mass removal and reduced long-term impacts of residuals after treatment.

- Applicant

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

I gave this a most likely since the process by the information provided works but then adding in the solar power portion leaves the factor of the weather and having enough sun to supply the power that is needed which could extend the time needed to complete the clean up activities.

- Reviewer: G-44-02A

- Rating: 4

Laboratory testing has demonstrated that the goals are achievable. Similar field work has demonstrated that it is achievable.

- Reviewer: G-44-02B

- Rating: 5

Success will be dependent on the agency and closure targets. Operator needs to work with agency to define closure plan. It would be beneficial to see a greater understanding on how the operator plans to maintain surface equipment and solar panel to assure downtime and efficiency. Schedule PM's etc. If power is available then why not just use available power? Is the intent of the project to remotely remediate releases or is the primary intent to remediate site. If so, why not use power available if economic?

- Reviewer: G-44-02C

- Rating: 2

Since chloride impacts groundwater and receptors tend to be a distance away, risk-based cleanup targets are sometimes used. Oasis is negotiating with NDDoH to determine effective closure. At other sites, they appear flexible on final limits and receptive of mass removal targets or average limits. Once installed, the equipment will be operated and maintained by Oasis, or their local contractor, much like the existing unit at Connie site. The site is visited at least weekly to collect field data, check operations and perform any maintenance. There is line power available at the proposed site and can be used as a fall-back. However, to develop a more sustainable and flexible desalinization system, integrating with solar power makes more sense. We will learn the benefits and drawbacks to solar power for use at more remote sites where line power is not practical. Also, there is a groundwater recovery system in place that can serve as a backup containment for any remaining brine contamination, which can be operated until the closure is accepted by the regulators. If this process works as anticipated, the site could be closed in 3 years where as the capture system alone would have to run for decades. Therefore, containment safeguards and backup power make this site ideal for the further developmental of the EK desalinization process.

- Applicant

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

No comment

- Reviewer: G-44-02A

- Rating: 4

Methodology is based on sound science, laboratory trials and lessons learned from past field work.

- Reviewer: G-44-02B

- Rating: 5

This out of the box approach could benefit multiple operators in Western North Dakota if agencies agree on achievable remediation targets. What is the plan if remediation is successful per the study, but does not meet NDDoH closure standards?

- Reviewer: G-44-02C

- Rating: 4

If the process does not meet the NDDoH closure standards, it can still be viewed as the primary tool to reduce mass and reduce overall cleanup times. Then, if needed, implementation of other remediation activity can be decided by the operator and NDDoH.

- 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:

This project could help in developing an extremely useful tool to help clean up salt impacted areas from historical oil production in the state that it is cost prohibitive to use the most common dig and haul method.

- Reviewer: G-44-02A

- Rating: 5

This is a procedure that could be utilized in almost any area.

- Reviewer: G-44-02B

- Rating: 5

If successful, this remediation technique could be useful, but may not meet agency cleanup standards. Therefore may need further evaluation with if remediation techniques is viable.

- Reviewer: G-44-02C

- Rating: 3

This remediation process is in development and cannot fully guarantee full compliance with all treatment standards at any site at this time. Laboratory studies and the field pilot at Connie demonstrate large amounts of salt can be removed. Ongoing optimization of the EK operations at the Connie site is providing valuable insight as to how additional contamination can be removed. We believe the further development of the EK process proposed will be a viable restoration alternative to treat difficult, even remote sites. Oasis is negotiating with the State regarding cleanup criteria at the proposed location to better match the EK process current removal efficiencies.

- 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:

No comment

- Reviewer: G-44-02A

- Rating: 3

The literature is very relevant

- Reviewer: G-44-02B

- Rating: 4

Has this approach been done elsewhere and what were the results? If not done elsewhere, has a similar technology been used in other states for remediation and what were the results?

- Reviewer: G-44-02C

- Rating: 3

A field-scale pilot EK desalinization system is operating at the Oasis Connie site with good chloride reductions. The Connie site is difficult as it consists of salt contaminated silt and clay under a slough. Contaminated soils and water were removed as emergency response. However, some of the brine release reached a small slough and contaminated the soils below to a depth of 10 feet. Excavation was not practical and sump/groundwater controls would require many years of operation. The EK system removed 40% of the chloride during the first six months of operation. There is another entity in Canada (Ground Effects) purportedly developing EK based remediation systems. The applicant is unaware of any documented examples of this company's successful removal of salt contamination in the subsurface or groundwater.

- 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:

A schedule is provided with management plan that was developed from a computer model.

- Reviewer: G-44-02A

- Rating: 3

No chart was included but the plan and timetable is clear.

- Reviewer: G-44-02B

- Rating: 3

Sampling and success of sampling need to be further defined and possibly have more data points. In addition, sampling procedure, collection, lab and costs are not identified.

- Reviewer: G-44-02C

- Rating: 2

The proposed site consists of contaminated soils above contaminated groundwater that sometimes discharges to a small vernal stream. The EK system will be applied to both saturated and unsaturated zones. Therefore soil and groundwater samples will be used to guide operations and determine the effectiveness of the system. Samples collected at the beginning and end of each operating period (spring to fall) to judge the performance and determine if additional operating time is needed. Samples will be collected and analyzed using state approved methods.

- Applicant

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

The purchase of equipment is justified since there are many items that can only be used once such as the electrodes.

- Reviewer: G-44-02A

- Rating: 3

The need for all equipment is justified.

- Reviewer: G-44-02B

- Rating: 4

There is no detail of what labor/equipment are needed and no specifications of equipment and scheduled rates. This section needs some more detail to further define economics.

- Reviewer: G-44-02C
- Rating: 3

The "big-ticket" equipment consists of a power supply and electrode wells with special DSA electrode wires. Other equipment includes buss wires, tubing and multi-head pumps with special tubing to handle the brine and pH conditions. Contractors with direct-push equipment will be used to install the wells and collect the environmental samples (direct charges). Terran will provide designs, engineering and O&M oversight.

- Applicant

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

No comment

- Reviewer: G-44-02A
- Rating: 4

The cost of the project in relation to other remediation methods is outstanding

- Reviewer: G-44-02B
- Rating: 5

There needs to be more specifics regarding labor and rates. Additionally there are no details regarding schedule of equipment, maintenance, and direct and indirect monitoring. More details are needed in proposal.

- Reviewer: G-44-02C
- Rating: 2

The labor rate charged NDICs share is \$130/hr for a lead scientist/engineer (Chris Athmer) to provided design/engineering, assistance in the installation, and oversight for operations and monitoring over the three year period as well as periodic updates and annual reports. The match by Oasis included preliminary site investigation work (mostly done, needed for design work), site contractors for installation, O&M and sampling. There will likely be a need for enhanced sampling from time to time for troubleshooting or final evaluation (end point determination).

- Applicant

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

There is a 50% commitment from Oasis.

- Reviewer: G-44-02A
- Rating: 3

The applicant is covering the cost that may be potentially higher.

- Reviewer: G-44-02B
- Rating: 4

No comment

- Reviewer: G-44-02C
- Rating: 3

The cost estimate is based on a fair target costs based on similar projects. There is no contingency in our cost estimate. Terran and Oasis will cover any escalation or cost over-runs.

- 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 only flaw I see is that the project takes years to complete but since the process is showing great results it out ways the time it takes to complete. With all the acres in the state that have been affected by produced water spills more tools are needed and this one is showing lots of promise for restoring unusable land.

- Reviewer: G-44-02A

This project is an exceptional project in that it provides the potential to remediate brine spills in almost any area with out the need to replace soils. There is always an unknown in any pilot test. Similar pilot test have had issues but the applicant has applied lessons learned from those issues.

- Reviewer: G-44-02B

This study will benefit Western North Dakota if it is successful, but the definition of success (by the agency) needs to be defined prior to awarding funding. A path forward needs to be defined if the project is successful, but does not meet agency expectations. How will the the success of the remediation be determined? What are the economics (if source is close) of bringing power into the remediation rather than solar. Will remediation have a higher success rate? How many remote remediation's occur in Western ND and how many of them had power in close proximity versus the need for solar? Would it be feasible to study the affects of both power and solar on the remediation? Economics need to be further defined(bided or compared) if necessary to determine if rates are reasonable for solar/ labor etc. Additionally, maintenance schedule should be outlined to ensure all equipment is functioning optimally. Lastly, for the materials the state pays for, does the state get to keep the materials, if so what are they? Sampling criteria, pulling procedure, and schedule need to be defined and agreed upon prior to awarding proposal. How much was estimated that was leaked from the release and what was recovered? What levels of impact are in the soil/groundwater? If soil impacts are above the root zone, will additional amendments need to be placed down to stimulate vegetative growth on surface. What is the strategy after three years? May wan to evaluate if amendments be added now to work in conjunction with the proposed study?

- Reviewer: G-44-02C