

**EERC Response to North Dakota Industrial Commission's
TECHNICAL REVIEWERS' COMMENTS**

LRC-LXXI(71)-A: "Field Evaluation Of Novel Approach For Obtaining Metal Emission Data"

Submitted by: Energy & Environmental Research Center
Request for: \$235,120; Total Project Costs: \$573,000;
Project Manager: John H. Pavlish;
Project Duration: 12 Months.

1. OBJECTIVES

The objectives or goals of the proposed project with respect to clarity and consistency with Industrial Commission/Lignite Research Council goals are: 1 - very unclear; 2 - unclear; 3 - clear; 4 - very clear; or 5 - exceptionally clear.

Reviewer 11-01 (Rating: 4)

EPA Maximum Utility MACT standard will likely increase the use of M26 and M26a regulatory compliance reductions of HAPs that could significantly increase costs associated with stack emission tests and verify and compliance using Method 29 and M26a. The compliance could require stack sampling as often as every 2 months at requiring personnel and complicated setup and recovery process for M29 and M26a emission monitors to measure emission concentrations, a significant part of the cost impact.

Participants at a recent national conference expressed a need for a simpler and more cost-effective method to obtain plant emission data to address the Utility MACT standard. The project team and the OhioLumex Company have developed a multi-element sorbent trap method that may reduce the complexity and cost of monitoring emissions, thus reducing costs .

The objective is to evaluate the EERC multi-element sorbent trap (ME-ST) at two lignite plants.

Reviewer 11-02 (Rating: 4)

The goal of this proposal is twofold: 1) to evaluate the EERC-developed ME-ST technology at two ND lignite-fired full-scale sites and 2) to provide metal and halogen emission data at these sites. In addition, the proposal identifies ten (10) specific objectives and five (5) work tasks designed to achieve these objectives.

These goals and objectives are consistent with NDIC/LRC goals. The goals of this project will help preserve existing jobs, ensure economic stability in the industry and State, and be conducted in an environmentally sound manner to protect the state's air, water and soil resources.

The proposal does not associate specific proposal goals and objectives with specific NDIC/LRC goals and objectives.

Reviewer 11-03 (Rating: 3)

The objective of the proposal is to reduce the costs of regulatory compliance, and this is aligned with the goals of the NDIC. This is stated in the proposal, and the proposers say that they will estimate measurement costs as part of the proposal. However, no specific information is presented in the proposal to suggest that costs will be lower.

EERC Response: *The EERC appreciates the opportunity to respond to the reviewers' comments. This method reduces the need for chemicals, equipment, and sample preparation steps prior to analyzing the sample. It also reduces the chance for sampling-related errors, problems with shipping the samples to a laboratory (pH and chemical composition of the samples constitutes a hazardous waste), and allows for a simpler process that can be performed with significantly less training than that needed for wet-chemistry methods.*

Currently accepted sampling methods are a mixed bag of wet- and dry-chemistry methods.

While a Hg CEM can be used specifically for mercury, a comparable, validated online emissions monitor is not available for other trace metals. Also, EPA Method 30B (modified) sorbent trap method is accepted for mercury, but it is not a recognized method for trace metals. So while a utility may use these methods specifically for establishing mercury emissions, the wet-chemistry EPA Method 29 is required by EPA for measurement of all trace metals.

In addition, laboratory-grade, metal-free chemicals are very expensive to keep contaminant-free, ship, store, and transport, so eliminating their use in the field presents significant savings. Utilities that have installed Hg CEMs have needed to add at least a quarter- to half-time person to keep the monitors within operationally acceptable limits. Again, these monitors only provide measurement of mercury.

Halogens are also typically sampled using a wet-chemistry method, EPA Method 26A. The ME-ST method for halogens will have the same benefits as discussed above for trace metals.

The traps and sampling apparatus are not yet commercially available and have not been tested at full scale. Side-by-side full-scale testing is needed to generate the comparative supplies and personnel hours required for an ME-ST sample in order to directly compare to an Method 29 sample. Thus while it is impossible to compare methods apples to apples, the EERC expects that the costs will be at least <50% of that needed for wet-chemistry methods for trace metals and <50% of that for halogens. More accurate cost data estimations will be generated following the full-scale testing and are a part of the proposed work.

2. **ACHIEVABILITY**

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 11-01 (Rating: 4)

The project schedule and budget appears achievable. The proposers will identify two lignite-fired test sites.

Reviewer 11-02 (Rating: 4)

With the approach suggested the objectives are most likely achievable. The work tasks should be achievable. Some uncertainty may exist with the comparability of the EERC ME-ST data and the EPA M29 and M26a within acceptable tolerance. In addition some uncertainty may exist with the willingness of EPA to accept different or non-EPA methods.

Reviewer 11-03 (Rating: 2)

Twelve months should be sufficient to carry out two field campaigns, given that EERC personnel are very experienced at field sampling. No details of the budget are provided; thus, it is not possible to evaluate whether the objectives are achievable within the proposed budget. A ranking of “possibly achievable” is therefore given.

EERC Response: *The EERC is quite experienced at field testing, so we are confident that the costs are sufficient to complete the scope as proposed. Our project is contingent upon executing two host agreements with North Dakota utilities, which we do not expect to be a problem given our cooperative working relationships and the benefits that could accrue to the hosts.*

Regarding the comparability of the data, we would like to point out that one must consider several factors when considering the true detection limits that can be obtained from a method; this includes both sampling and analytical margins of error. This project will provide us with additional information to evaluate both margins of error, which we expect to be smaller on both accounts, providing a lower detection limit with higher data reliability.

In previous extensive EERC research to evaluate and validate other methods, it has been important to obtain sufficient data to statistically evaluate the method using different coals under tightly controlled environments. EPA is willing to accept new methods that pass EPA Method 301 validation. Method 301 is a procedure developed by EPA for determining the precision and accuracy of candidate methods. The next step beyond this project is to move forward and carry out Method 301 on the ME-ST for trace metals and halogens.

3. **METHODOLOGY**

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 11-01 (Rating: 4)

The EERC organization is a mature and organized group of engineers, chemists and support experts. The methodology, equipment, and personnel are excellent. The objective will be to evaluate the EERC-developed ME-ST technology at two lignite plants using the OhioLumex sorbent plant to compare existing methods.

Reviewer 11-02 (Rating: 5)

The quality of the methodology displayed in this proposal is well above average. The proposal identifies overall and specific objectives and relates these objectives to specific work tasks and timeframes. In addition, the proposal identifies specific standards of success.

Reviewer 11-03 (Rating: 4)

The methodology for choosing sampling sites and carrying out the sampling and analysis is described in the proposal in sufficient detail. The methodology for making the proposed new measurement methods, which is apparently proprietary, is not described in sufficient detail to evaluate.

EERC Response: *The EERC appreciates the reviewers' confidence in our methodology. The process is proprietary, but the methodology is sufficiently developed to give confidence in the data that are obtained. The EERC was one of the first organizations to do extensive testing of dry sorbent traps, providing a good basis for understanding possible problems and ways to deal with challenges in a straightforward manner.*

4. **CONTRIBUTION**

The scientific and/or technical contribution of the proposed work to specifically address Industrial Commission/LRC goals will likely be: 1 – extremely small; 2 – small; 3 – significant; 4 – very significant; or 5 – extremely significant.

Reviewer 11-01 (Rating: 4)

The EPA has proposed a Maximum Achievable Control Technology (MACT) for utility emissions that will require complex stack emission measurements. The Maximum MACT approach would increase plant costs due to the complexity of emission monitoring equipment and personnel. In general, such monitors are expensive and require skilled engineers. The OhioLumex sorbent trap may provide a less complex emission capture that would decrease cost and complexity of emissions monitoring that could provide a significant contribution to utilities.

Reviewer 11-02 (Rating: 5)

The proposal addresses a critical issue for the lignite industry. The scientific and technical contribution of the proposed work can be extremely significant. The proposed HAPS rules are extremely important to the industry.

Reviewer 11-03 (Rating: 2)

The objective of the proposal to reduce the costs of regulatory compliance, specifically by offering an alternative to making Method 29 and Method 26 measurements for metals and halogens, respectively. No quantitative information is presented to support this argument. Conceptually, the proposed method should be less expensive in terms of labor and materials than conventional impinge-based methods. However, it is difficult to evaluate these claims. Furthermore, it is not certain that a utility will have to use the impinger-based methods (Method 29 and Method 26) for compliance and therefore it is not certain that a utility will benefit from an alternative to impinger-based methods. The proposers should have provided more details on projected costs of using the proposed methods.

***EERC Response:** The EERC shares the perspective of Reviewers 1 and 2. While there is plenty of work to do yet to submit this method to a committee (EPA or ASTM) for review, given the success of EPA Method 30B, we expect that it would be approved once sufficient data are obtained. Please note that this project will also evaluate this method for obtaining reliable halogen data. While a commercial HCl CEM is being developed, there are concerns about its reliability and accuracy in a flue gas environment. Halogen emission limits under the proposed utility MACT rule will require measurements in the 1.5 to 2 ppmvd at 3% O₂ range, which is difficult with Method 26A, and demonstrates the need for additional measurement techniques such as the ME-ST.*

5. AWARENESS

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 11-01 (Rating: 4)

Better than average. The PI and coworkers have published numerous lignite R&D research addressing lignite issues. The EERC R&D group is widely acknowledged by their national and international peers.

Reviewer 11-02 (Rating: 5)

The principal investigator's awareness of current research activity and published literature is exceptional. EERC and CATM are leaders in this area. The PIs provide references and demonstrate an exceptional awareness in the Statement of Work and BACKGROUND sections of the proposal.

Reviewer 11-03 (Rating: 5)

The proposers are aware of the details of the proposed utility MACT rule and about the profile of emissions of metals and halogens from coal-fired power plants.

EERC Response: We thank you.

6. BACKGROUND

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 11-01 (Rating: 4)

The EERC Project Team lead by John Pavlish has an experienced and capable team with extensive experience with North Dakota power plants.

Reviewer 11-02 (Rating: 5)

The background of the investigators as related to this area of research is exception. EERC and CATM are leaders in this field.

Reviewer 11-03 (Rating: 5)

The investigators have considerable experience in making the required measurements and in carrying out field-sampling campaigns.

EERC Response: We thank you.

7. PROJECT MANAGEMENT

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 11-01 (Rating: 3)

The project management plan is adequate.

Reviewer 11-02 (Rating: 5)

The proposal is complete with a project management plan containing an Organization Chart, Statement of Work, Project Schedule, Milestones and Decision Points.

Reviewer 11-03 (Rating: 2)

The discussion of the planning and execution of the on-site testing is good. EERC has a good QA/QC plan in place, which will maintain the quality of the results. No details of the budget are provided; therefore, the project management plan is inadequate.

EERC Response: Appendix D of the proposal included a detailed budget and corresponding budget notes.

8. EQUIPMENT PURCHASE

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 11-01 (Rating: 5)

Note: Reviewer 11-01 provided no comments.

Reviewer 11-02 (Rating: 5)

Note: Reviewer 11-02 provided no comments.

Reviewer 11-03 (Rating: 5)

It appears that no equipment will be purchased, although this is not stated explicitly.

EERC Response: No equipment is needed.

9. FACILITIES

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 11-01 (Rating: 4)

The EERC group will typically provide in-house equipment. Additional in-kind cost will be provided by OhioLumex in the form of approximately 80 custom sorbent traps with an approximate value of \$4,000. Testing will be conducted at the two lignite power plants.

Reviewer 11-02 (Rating: 5)

The facilities at EERC are exceptionally good.

Reviewer 11-03 (Rating: 4)

In general, the facilities available at EERC are very good and well suited to executing the proposed work.

EERC Response: Thank you.

10. BUDGET

The proposed budget "value"¹ relative to the outlined work and the financial commitment from other sources² is of: 1 - very low value; 2 - low value; 3 - average value; 4 - high value; or 5 very high value.

IV-A-3-6

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.

² Financial commitment from other sources – A minimum of 50% of the total project must come from other than Industrial Commission sources to meet the program guidelines. Support greater than 50% from Industrial Commission sources should be evaluated as favorable to the application.

Reviewer 11-01 (Rating: 5)

If the EERC R&D group is successful in reducing the cost of emission monitors and associated personnel, and reducing environmental impacts, the budget value would be high value.

The proposed budget is \$573,000.

Reviewer 11-02 (Rating: 4)

The proposed budget is of a high value. The request from NDIC/LRC represents 41% of the total project.

Reviewer 11-03 (Rating: 3)

The financial commitment from other sources is considerable, which provides a high leverage on the requested funds from NDIC and which demonstrates a strong commitment from industry. However, in another sense it is difficult to evaluate the value of the proposed work, because no details are provided on the budget.

EERC Response: As stated by Reviewer 11-01, the value of the proposed work is to reduce the cost and personnel hours associated with compliance sampling while at the same time reducing environmental impacts and providing accurate, reliable data.

OVERALL COMMENTS AND RECOMMENDATION:

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 11-01 (Rating: FUND)

The EPA has proposed a Maximum Achievable Control Technology (MACT) for utility emissions that will require complex stack emission measurements. The Maximum MACT approach would increase plant costs due to the complexity of emission monitoring equipment and personnel.

EERC R&D OhioLumex have developed an approach to verify stack emission monitor accuracy and sampling apparatus has taken the emission samples using the EERC and OhioLumex sorbent traps.

General comments: FUND

Funding: Total: \$573,000

NDIC - \$235,120

DOE - \$220,205

OhioLumex will provide 80 custom sorbents valued at \$4,000

Utilities cost share TBD: \$117,675

Reviewer 11-02 (Rating: FUND)

This proposal is exceptional. The proposal is well written, the Statement of Work well defined and the research team outstanding.

The proposal would be improved if the project cost benefit was demonstrated. How do the costs of the EPA methods and the proposed EERC techniques compare? The justification for the proposed work is based on the “need for simpler, more cost-effective methods to obtain the data required under the upcoming Utility MACT standard?” It is stated that the EERC “multielement sorbent trap (ME-ST) sampling method for traced metals and /or halogen emissions --- is much easier and robust,-- offering significant cost savings over the comparable EPA Methods 29 (M29) and 26a (M26a).” (See Proposal page 6)

What is the cost benefit of the EERC method? Will EPA accept the proposed EERC method?

Reviewer 11-03 (Rating: FUNDING MAY BE CONSIDERED)

The proposed measurement method appears to be novel and, if proven, could improve measurement methods and reduce the cost of compliance. However, the proposers do not make a convincing case for the cost reductions that could be achieved. This makes it difficult to assess the potential savings for compliance. Since these savings are the main justification for the proposed work providing value for the investment of NDIC funds, the reviewer cannot make a strong recommendation for funding this work.

The proposers have done pilot-scale sampling for metals and provided those data. The agreements between their method and Method 29 for individual metals are not compared quantitatively (and are presented on a semi-log scale). There are some significant differences that are obscured by a logarithmic scale. They do not discuss the method detection limits as compared with the proposed limits for individual metals in the utility MACT. This is an important part of the argument in favor of the method and it should be discussed.

The proposers do not present any data on halogen measurement with their proposed method. This makes the reviewer skeptical that this part of the method is ready for full-scale testing.

Technically, the proposed method does not seem to be ready for full-scale testing. The proposers have not shown any halogen data and the metals data show promising trends, but the agreement between the proposed method and Method 29 seems semi-quantitative. As noted above, a more quantitative discussion of the pilot-scale data might be more convincing. Both these factors, suggest to the reviewer that the method would benefit from additional pilot-scale testing, instead of field testing.

The value to NDIC is not strongly shown and the method does not appear to be at a stage of development (based on the data presented in the proposal) that is ready for full-scale testing. Therefore, the proposed program is not highly rated for funding.

EERC Response:

As stated above, the EERC expects that the costs of employing the ME-ST will be atleast <50% of that needed for wet-chemistry methods for trace metals and <50% of that for halogens. More accurate cost data estimations will be generated following the full-scale testing and is part of the proposed work.

The EPA is willing to accept new methods that pass EPA Method 301 validation. M301 is a procedure developed by EPA for determining the precision and accuracy of candidate methods. The next step beyond this project is to move forward and carry out M301 on the ME-ST for trace metals and halogens. The EERC has been successful in working with companies to validate methods and aided in the development of the OH and M30b methods.

The testing of the ME-ST method consists of only half of the proposed work. The other half entails obtaining trace metal and halogen emission data from two full-scale units using approved EPA reference methods. This data will be significant for the utilities because it will provide them with data that they can use to determine if they are currently compliant with the proposed utility MACT rule. The data will be critical in determining whether additional emissions control devices are needed in the near future to maintain compliance with the pending MACT rules. The proposed work utilizes full-scale testing in order to provide the valuable emission data for the host sites (and all lignite fired units) as well as an opportunity to further validate the ME-ST method.

The EERC believes that the feasibility of the ME-ST method has been adequately demonstrated at the pilot-scale level, and that full-scale testing is needed to determine how well the method performs at a full-scale setting. Full-scale data needs to be collected in order to demonstrate compliance and to ensure that no issues develop when transitioning from pilot- to full-scale testing.

At the time of the proposal submission, the proposed Utility MACT rule had not been presented in the CFR, and numerous errors were noted in the published EPA draft. The presentation will include a table that shows that ME-ST, M29, and M26A detection limits and the emission limits in the proposed utility MACT rule.

Halogen data from ME-ST sampling from a recent pilot-scale test run will be presented at the NDIC meeting.