

IV.B.3

RESPONSE (*in italics*) TO TECHNICAL REVIEWERS' COMMENTS

LRC-LXXVII(77)-C:

“Validation of the Multielement Sorbent Trap (MEST) Method for Measurement of HCl and Metals”

Submitted by: Energy & Environmental Research Center (EERC)

Request for: \$245,000; Total Project Costs: \$860,000;

Principal Investigator: John H. Pavlish, Senior Research Manager

1. OBJECTIVES

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

Reviewer 14-07 (Rating: 2)

The proposed validation of the Multielement Sorbent Trap (MEST) testing method has the potential to bring down the cost to demonstrate compliance with the U.S. Environmental Protection Agency (EPA) Mercury and Air Toxics Standards (MATS) Rule. The proposed project will meet the goal of helping “preserve jobs involved in the production and utilization of North Dakota Lignite” by lowering the cost associated with lignite utilization by electric generating units. However, the majority of the cost of compliance with EPA’s MATS Rule will occur from meeting the standard itself by achieving greater removal of the pollutants in the flue gas. Therefore since the proposal only helps to reduce the demonstration of compliance relative to an existing more exhaustive process, it does not necessarily ensure economic stability and growth of the lignite industry.

EERC Response: The EERC agrees that the availability of a lower-cost compliance measurement option will only help the lignite industry remain competitive; whereas, the largest cost is likely in installation and operation of effective control technologies.

Reviewer 14-08 (Rating: 2)

Page 2 of the report suggests that “M26 and M29 sampling may be needed as often as every 3 months”. On page 17 the saving between M29 and MEST-M is about \$1,300 per test. The savings between M26A and MEST-H is about \$1,100 per test. Therefore assuming these tests are performed four times a year the expected savings is $4 \times (1,300 + 1,100) = \$9,600/\text{yr}$. This is small in comparison to the costs required to install emission control technology and small compared to the costs required to operate emission control technologies. Given the other significant cost challenges facing the coal industry related to emission control, the cost reductions proposed here will be quite small. The cost of this project is \$860,000. The cost of this project is comparable to the costs savings expected for 90 years’ worth of tests on a single plant. I don’t see how this is a good use of Commission funds given the small savings in costs expected. I may have missed something. The project does appear to have significant industry support.

EERC Response: While the EERC agrees that the cost to comply with MATS is mostly with technology installation and operation, the cost of measurement to the utility industry is also quite significant. Based on most recent data, EERC estimates that for quarterly sampling of HCl, the cost savings is approximately \$25,000 per unit per year, as shown in the slide below which will be presented at the EPRI CEM conference May 14-15, 2014. The cost that the reviewer estimates is low by a factor of 5 since there would be 4 samples (3 plus 1 extra to ensure a minimum of 3 reportable) taken during each quarterly sampling period. Assuming that only 10% of

the 1200 plants use the MEST-H method, this would equate to an annual savings of approximately \$3,000,000/yr (120 x \$25,000). The cost savings for the MEST-M is estimated to be about the same.



Estimated MEST Time and Cost Savings

Estimate for Each Sample

	M29	MEST-M	M26A	MEST-H
Labor, min	810	360	600	240
Costs				
Labor	\$1320	\$610	\$980	\$400
Supplies	\$325	\$100	\$230	\$50
Misc. ¹	\$560	\$100	\$450	\$70
Analysis ²	\$330	\$440	\$20	\$40
Total	\$2535	\$1250	\$1680	\$560

TRC Corporation (Krenzke et al.*) reported a cost of approximately \$5000–\$7000 per three samples of M26, or about \$2000 per M26 sample (this cost does not include travel, hotel, and per diem).

Annual savings for HCl sampling is projected to be approximately \$25,000/stack.

1) Shipping samples, sample disposal, disposal of analytical waste, reporting, contingency.

2) Includes analyses of A and B traps for MEST.

*Krenzke, R.J. et al., "Mercury and Air Toxics Standard (MATS) Emission Testing Requirements, Recommendations, and Cost Comparisons," TRC Environmental Corporation, Air Quality Conference, Oct 2013.

Reviewer 14-09 (Rating: 3)

The proposal's goals are clear with respect to attempting to have a sorbent trap method (MEST-H) approved by EPA for the measurement of HCL emissions. The goal of the project concerning an approved method for the measurement of metals (MEST-M) is less clear.

EERC Response: Based on industry interest expressed to date, the goal is to first and primarily focus on getting the MEST-H method approved by EPA for immediate use by industry. A secondary goal is to advance the MEST-M method towards acceptance by EPA.

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 14-07 (Rating: 3)

The timeline in the proposal shows that the data reduction and statistical analysis of the test results will be completed by November of 2015 with reporting to be completed by the end of calendar year 2015. The generators will have to show compliance no later than April 16, 2015.

EERC Response: The EERC recognizes that the MEST-H method will unlikely be approved in time to be used at the start of MATS compliance. However, many utilities plan to use M26 quarterly sampling from the start. As soon as the MEST-H method is approved by EPA, it can then be used to easily replace M26, with immediate cost savings realized. The stack sampling companies that perform M26 sampling have the equipment readily available to switch over to MEST-H sampling instead.

Reviewer 14-08 (Rating: 3)

Very little information was provided on the test schedule and what they proposed to test when.

EERC Response: The EERC provided as much detail as was possible at the time the proposal was formulated. The EERC intends to perform tests as needed and on a schedule that is set based on discussions with EPA. The main goal of the project is to provide EPA with the data that they identify as missing, as soon as they identify/request additional data.

Reviewer 14-09 (Rating: 2)

Although the time frame and budget for the project appear feasible, EPA has a history of requiring significant time before approving any changes to existing methods. I believe the fact the EPA's approval is ultimately what is needed for this project adds some risk to the proposal.

EERC Response: Initial discussions with EPA have been very favorable. EPA recognizes that M26 (and M26a) have issues and can be costly, and that there is a real need for a simpler less costly method. They would also like to have more than one method of choice.

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 14-07 (Rating: 3)

For the lignite fired utilities which will be required to demonstrate compliance with the HCl emission standards through quarterly emission testing which is not a part of their current compliance regime, the MEST-H testing will offer simplicity, safety and cost savings over EPA's Method M26 or M26A. Facilities which can meet the surrogate standard of 0.2 lb/MMBtu SO₂ and choose to do so, currently require SO₂ CEMS under Part 75 and will not incur any additional costs associated with demonstrating compliance with the HCl MATS.

It is my understanding that most North Dakota lignite plants can currently meet the nonmercury metal standard by demonstrating compliance with the surrogate particulate matter standard utilizing existing pollution control equipment and will not be forced to demonstrate compliance using EPA's Method M29 or the proposed MEST-M Method. If generators choose to demonstrate compliance through the particulate matter surrogate, they can demonstrate compliance through quarterly testing using EPA Method 5 which is currently being done once a year.

EERC Response: Having available low-cost measurement methods provides utilities with more options moving forward. The MEST method can also be used to assess technology performance. This provides a lower cost option to collect HCl and/or nonmercury metals data while assessing different control options/scenarios. Reviewer 14-09 feels the approach proposed is “well thought out and scientifically defensible.”

Reviewer 14-08 (Rating: 5)

Presumably the methodology to be employed is sufficient to convince the EPA that their sampling approach and data measurement are appropriate for use to measure various emissions. The use of performance monitors is also a good idea.

Reviewer 14-09 (Rating: 4)

The methodology explained concerning the research that supports the proposal, as well what is planned going forward appears to be well thought out and scientifically defensible.

EERC Response: Thanks!

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4. CONTRIBUTION

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

Reviewer 14-07 (Rating: 2)

The proposed testing method will provide value to the generators that are required to use them in the form of reduced compliance demonstration costs which will help the industry stay competitive. However, the magnitude of the cost savings will be small in comparison to meeting the actual emission standards themselves. In that regard, the proposed validation of the test methods will have a small effect on the overall sustainability of lignite fired generating units in North Dakota.

EERC Response: The costs estimated by the EERC are larger than estimated by the reviewer and are approximately \$50,000 per year for each plant stack. See EERC response below for more detail.

Reviewer 14-08 (Rating: 2)

As stated above it is hard to conceive that saving of less than \$10,000 per year at a coal plant will have much of an impact on the economic fortunes of the coal industry.

EERC Response: The costs estimated by the EERC are approximately \$50,000 per year for each plant stack. Based on most recent data, EERC estimates that for quarterly sampling of HCl, the cost savings is approximately \$25,000 per unit per year, as shown in the slide below which will be presented at the EPRI CEM conference May 14-15, 2014. The cost savings for the MEST-M is estimated to be about the same. The cost that the reviewer estimates is low by about a factor of 5.



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Reviewer 14-09 (Rating: 3)

If a simplified method can be approved for the measurement of HCL, the cost to the industry for the emissions testing should be reduced which may further the efficiency of burning lignite to produce electricity.

EERC Response: The EERC believes that there are significant cost savings that can be realized by using the MEST method during evaluation of technology options and for compliance reporting.

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 14-07 (Rating: 4)

Many of the references listed in the proposal are from previous work done by the investigators in this particular field of study leading up to the development of the MEST Method. The research team has substantial experience working with sampling and emission control of air toxic metals in a variety of industries and applications.

Reviewer 14-08 (Rating: 4)

It is clear that the proponents understand their competitors' technology and what standards are required by the EPA.

Reviewer 14-09 (Rating: 4)

Based on the proposal, it appears Mr. Pavlish and Mr. Dunham's experience in research concerning coal combustion and measuring emissions is above average.

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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 14-07 (Rating: 5)

The investigators background is very thorough as shown in the proposal. The research team has substantial knowledge and experience developing and testing new technologies at North Dakota's lignite fired generating units. The resumes of key personnel highlight the many projects and years of research that has been done at the EERC by Mr. Pavlish and Mr. Dunham.

Reviewer 14-08 (Rating: 5)

They seem to have developed a good team of investigators at the EERC. In addition the inclusion of the performance monitors and the EPA is a good idea.

Reviewer 14-09 (Rating: 4)

See comment No. 5.

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 14-07 (Rating: 4)

The proposal illustrates the timeline and communication plan well and the team has a good understanding of what to expect from their previous round of testing done on site at MDU's Lewis & Clark Station located in Sidney, MT. A thorough financial plan is outlined in the proposal.

Reviewer 14-08 (Rating: 4)

The project schedule has some information in it. A detailed budget was provided. It did appear that significant communication between the stakeholders was planned for.

Reviewer 14-09 (Rating: 3)

With respect to getting EPA approval for the MEST-H plan for HCL, the plan appears adequate.

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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 14-07 (Rating: 5)

The EERC is fully equipped to conduct the proposed testing and validation.

Reviewer 14-08 (Rating: 5)

They plan to purchase 200 sorbent traps at a discount for the project. Beyond this no additional equipment appears to be required.

Reviewer 14-09 (Rating: 5)

N/A – based on the proposal, no additional equipment is to be purchased.

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 14-07 (Rating: 4)

The EERC has been a leader in the development of new technologies currently in use or consideration by the North Dakota Lignite Industry and many other industries. The analytical research laboratory is well equipped and has a substantial amount of experience analyzing samples for mercury, HAPS, Metals and various biological samples. The pilot-scale test combustor has the capability to closely emulate the particulate matter pollution control equipment being used at lignite fire plants. However there is no mention of a dry or wet scrubber flue gas desulfurization system at the pilot plant which will be utilized to remove not only the SO₂ but the HCl. The proposal calls for utilizing low chlorine coals which may compensate or bring the levels into the desired range of the compliance testing.

EERC Response: The EERC intends to use a low chlorine coal that should bring HCl emissions in the desired range for MEST-H validation. However, if necessary, the EERC does have both a dry and wet scrubber system available that may be used as necessary to regulate HCl emission to desired levels.

Reviewer 14-08 (Rating: 5)

EERC has a significant suite of testing equipment well suited to testing this technology.

Reviewer 14-09 (Rating: 4)

The proposal demonstrates that EERC's research facilities and equipment are quite capable to perform research activities described within.

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.

Reviewer 14-07 (Rating: 4)

Of the two existing test methods which EPA requires at this time, M29 and M26, or M26A, M29 is the more expensive test to conduct and currently would be utilized by few if any operators in the state as they will likely use the surrogate particulate matter EPA Method 5 test to demonstrate compliance with the nonmercury metals MATS. The alternate test to M29 being validated, the MEST-M Method may never be needed and is not being validated as a replacement test through the M301 process at this time.

A cost comparison given in the proposal of demonstrate compliance for the HCl regulation with either the existing EPA M26A Method and the proposed MEST-H would be approximately \$12,480 per unit per year, assuming 3 samples are taken at each quarterly test.

EERC Response: The EERC estimates a cost saving using the MEST-H of approximately \$25,000/yr/unit. See response above for more detail.

Currently the project has \$125K committed from industry out of the minimum requirement of the matching \$245K, which has been asked of the North Dakota Industrial Commission. Three remaining sponsors have expressed interest although no official letters have been submitted with the current proposal. Should the three remaining sponsors whom have expressed interest, The Illinois Clean Coal Institute, EPRI, and The National Rural Electric Cooperative Association, commit just half the dollars they are considering the project would be funded above the required 50% threshold.

EERC Response: The benefits of the proposed project clearly extend beyond ND, as is evident from support shown from ICCI, EPRI, and other utilities. The EERC has had discussions with both EPRI and ICCI and they have verbally stated that they and their respective members are very supportive of the project. Nebraska Public Power District (NPPD) has also recently committed to supporting the project, see attached letter from NPPD.

Reviewer 14-08 (Rating: 4)

The EERC has a good reputation for delivering good quality testing and results. There is also a high level of financial commitment and in-kind support from the other funders. *EERC Response: Thanks!*

Reviewer 14-09 (Rating: 4)

If the project secures the entire \$860,000 budget and the research proves the MEST is a reliable method, resulting in EPA approval, then the \$245,000 requested from the NDIC appears to be a good value considering the total cost of the project and the estimated reduction in emission measurement costs for the industry.

EERC Response: While the benefits extend to utilities beyond ND, the EERC agrees that the request of \$245,000 is a good value for the NDIC.

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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.

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 14-07 (Rating: DO NOT FUND)

The lignite industry requires diligent and well thought out innovation to meet the evermore stringent rules and regulations and remain competitive in today's energy markets. The validation of the proposed new sampling technique seeks to replace two testing methods which are cumbersome and expensive to conduct with a simpler more reliable testing alternative. This proposal seeks to reduce the cost and complexity of demonstrating compliance and should either of the tests be validated and approved by the EPA, they would in fact save the utilities money.

However, the MATS regulations allow operators to demonstrate compliance using surrogate parameters. Many of the plants which choose to use the surrogate parameters have the continuous emissions monitors or testing ability already in place to prove that the MATS emission limits are being met. The proposed MEST Methods would not be implemented. These plants will have minimal additional cost burden placed on them to demonstrate compliance and will not utilize the proposed MEST sampling methods.

EERC Response: A lower cost measurement option would also save utilities during times of evaluation, such as impact of HCl emissions when operations change, fuel changes, or during technology evaluations. With the exception of Minnkota Power, all of the other ND utilities have expressed support for the project, as shown in Appendix B of the proposal.

Not all operators will be able to meet the surrogate parameters and will be forced to show compliance with MATS for HCl through either the existing EPA testing methods, the proposed MEST-H testing method or through Continuous Emission Monitors (CEMS). Currently HCl CEMS are being developed and tested for utility operations. Once the CEMS are developed, the plants will likely use the CEMS to ensure that they are continuously in compliance rather than a single sample method. Plants currently operate and maintain a number of CEMS to monitor NO_x, SO₂, Opacity and in some cases particulate matter emissions and would likely add the additional HCl monitors. In this case the CEMS would be used in lieu of the proposed MEST sampling methods or the EPA test methods to show compliance.

EERC Response: Continuous HCl monitors have not been proven for compliance purposes within the range of the MATS limits. Ongoing testing is underway, but issues still remain. Another issue that also needs to be addressed is calibration standards for HCl monitors. At this time, there are no NIST certified calibration standards down at the 1-3 ppmv range. From discussions with utilities, the general opinion is that they are not interested in installing unproven HCl CEMS as they are generally complex (e.g. FTIR, etc.) and would require that additional technical experience be onsite. Given that the costs between selecting a HCl CEM and applying MEST-H quarterly sampling is expected to be similar to slightly less with the MEST-H, utilities have expressed that they would prefer to report HCl emissions on a quarterly basis. This trend appears to be consistent with the trend that more and more utilities intend to report mercury emissions using a sorbent trap approach rather than Hg CEMS.

Therefore, I do not recommend funding of the further development of the MEST sampling method through the North Dakota Industrial Commission Lignite Research Council. The impact to the lignite industry by simplifying the demonstration of compliance does not necessarily ensure that the plants can stay in compliance and hence preserve or create new jobs within North Dakota's Lignite industry.

EERC Response: The project proposed does not ensure compliance, but rather provides a lower cost option for utilities to demonstrate that they are in MATS compliance. The benefits of the project go clearly beyond the ND industry, and that is why ICCI, EPRI, and other utilities have expressed interest in funding the project. For example, Nebraska Public Power District has recently confirmed their interest in the project, see attached letter of commitment from NPPD. The request of \$245,000 from the NDIC “appears to be a good value considering the total cost of the project and the estimated reduction in emission measurement costs for the industry” as stated by reviewer 14-09.

Reviewer 14-08 (Rating: FUNDING MAY BE CONSIDERED)

As described above testing costs are only a small component of the overall cost to comply with emission reduction requirements. As such it is hard to see how such relatively small cost savings will materially impact the coal industry given the huge costs associated with installing and operating emission control technologies. It seems to me that it might be better to apply the Commission’s limited funds on projects which propose ways to reduce the cost of installing and operating emission control technologies.

Therefore given there is significant interest from the industry, I would recommend that “Funding May Be Considered”.

EERC Response: The costs estimated by the EERC are approximately \$50,000 per year for each plant stack, about 5 times higher than indicated by the reviewer. Based on most recent data, EERC estimates that for quarterly sampling of HCl, the cost savings is approximately \$25,000 per unit per year, as shown in the slide below which will be presented at the EPRI CEM conference May 14-15, 2014. The cost savings for the MEST-M is estimated to be about the same.

The benefits and interests of the project go clearly beyond the ND industry, as demonstrated by the interest gained to date, and as shown in Appendix B. Noteworthy, Minnesota Power and all of the ND utilities (except Minnkota Power) have expressed interest in seeing NDIC fund this project; EPRI has verbally expressed interest in funding the project because many of their members have voiced interest in the MEST approach; ICCI has verbally expressed interest as some of their members may not be able to meet the SO2 surrogate limit; and other utilities that have been contacted have expressed interest, as evident by NPPD’s recent commitment to the project (see attached letter).



Estimated MEST Time and Cost Savings

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Reviewer 14-09 (Rating: FUNDING MAY BE CONSIDERED)

In my opinion, the approval of a MEST method for both HCL and Metals would be welcomed by both industry and regulators. My concern with the proposal is that its title appears to indicate that the funding is to be used for the development of an approved MEST method for both HCL and metals, but a review of the proposal suggests that the researchers are only attempting to validate the MEST-H for HCL emissions. If funding allows, they hope to further their research on the MEST-M for metals. Funding of the project may be dependent on the trying to quantify what resources will be allocated to each MEST method.

EERC Response: The EERC agrees that both industry and regulators would welcome and benefit from acceptance of the MEST as an alternative method. As stated, the primary and near-term goal of the project is to obtain EPA approval for the MEST-H method to serve as an alternative method to M26 (and M26A). Consequently, most of the effort (~85-90%) proposed is focused towards getting EPA approval of the MEST-H method as an alternative method. Whatever funds remain will be directed towards advancing the MEST-M towards EPA acceptance.