ATTACHMENT C

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MEMORANDUM

TO: Rae Cronmiller, NRECA

FROM: Ralph L. Roberson, P.E.

DATE: June 16, 2023

SUBJECT: Technical Comments on EPA's Proposed Rule: Mercury and Air Toxics Standards Risks and Technology Review – PM CEMS

INTRODUCTION

Recently, the Environmental Protection Agency (EPA) proposed revisions to the Agency's Mercury and Air Toxics Standards (MATS) rule.[1] These revisions are the proposed response of EPA to its previously announced review of its 2020 Risks and Technology and Review (RTR).[2] Among other things, EPA proposes to eliminate the quarterly stack testing option for demonstrating compliance with the filterable particulate matter (fPM) emission standard. If EPA finalizes the rule as proposed, the only compliance option for fPM will be with a PM continuous emission monitoring system (CEMS). Compliance with the proposed emission standard of 0.010 lb/10^6 Btu will be based on 30-day rolling averages computed from hourly PM CEMS data.

The National Rural Electric Cooperative Association (NRECA) asked RLR Consulting LLC (RLR) to review EPA's proposed rule and to assist in preparing technical comments. NRECA asked RLR to focus its effort on the EPA requirement to mandate the use of PM CEMS to demonstrate compliance with the revised fPM emission standard.

REGULATORY DISCUSSION

Section 112(f) of the Clean Air Act (CAA) states, among other things, "if standards promulgated pursuant to subsection (d) and applicable to a category or subcategory of sources emitting a pollutant (or pollutants) classified as a known, probable or possible human carcinogen do not reduce lifetime excess cancer risks to the individual most exposed to emissions from a source in the category or subcategory to less than one in one million, the Administrator shall promulgate standards under this subsection for such category." Then, Section 112(d)(6) requires EPA to "review and revise as necessary

[1] 88 Fed. Reg. 24.854 (April 24. 2023).
[2] 87 Fed. Reg. 7.624 (February 9. 2022).

(taking into account developments in practices, processes, and control technologies), emission standards promulgated under this section no less often than every 8 years." Taken together, these two provisions of the CAA constitute what is termed EPA's Risk and Technology Reviews (RTR). Clearly, Section 112(f) is concerned with health risks and has nothing to do with compliance methods or procedures. Section 112(d)(6) concerns itself with revising numerical standards based on "developments in practices, processes, and control technologies." Thus, there appears to be no legal basis for EPA's proposed elimination of the quarterly stack testing option for demonstrating compliance with the fPM emission standard.

TECHNICAL DISCUSSIONS

The fundamental problem with PM CEMS is, and always has been, an issue of technology. That is, commercially available PM CEMS do not provide a direct measure of PM emissions. By direct measure, we mean that the instrument measures the mass of PM and the volume of flue gas from which that mass of PM was sampled. Rather, commercially available PM CEMS measure some property (i.e., light scatter or beta attenuation[3]) that must be correlated to actual stack PM measurements.

Correlation Testing and Data Range

The procedure and requirements for correlation testing are specified in EPA Performance Specification 11 (PS-11).[4] PS-11 requires a minimum of 15 test runs using the appropriate EPA reference method (e.g., MATS Method 5) spaced over three distinct PM concentrations (i.e., low, mid and high).[5] For the resulting correlation to be useful, these three distinct PM concentrations should span the range of expected concentrations with a target level (i.e., 50 percent of the limit) in the middle of the range.

A PM CEMS correlation curve plots the PM CEMS output on the x-axis and the reference method PM concentration on the y-axis. Reference method PM concentrations (y-axis) are typically expressed in the units of milligrams per actual cubic meter (mg/acm), and "actual" refers to the condition at which the PM CEMS detector operates. EPA is proposing to lower the filterable PM emission limit from 0.030 to 0.010 lb/10^6 Btu.[6] Conversion of 0.010 lb/10^6 Btu to mg/acm requires knowledge of the detector temperature and stack diluent (e.g., CO_2) concentration. If we use a typical CO_2 concentration of 12.5 percent (wet) and a detector temperature of 320 ° F, then 0.010 lb/10^6 Btu converts to 7.5 mg/acm. Following EPA's assumption that the unit will

[3] The EPA statement at 88 Fed. Reg. at 24,872, that a beta gauge "detector measures the amount of radiation emitted by the sample" is categorically incorrect and illustrative of several uninformed statements (e.g., cost estimates) about PM CEMS in the preamble to the proposed rule.
[4] 40 C.F.R. 60, Appendix B.
[5] PS-11 defines "low" to be zero to 50 percent of the maximum PM concentration; "mid" to be 25 to 75 percent of the maximum PM concentration; and "high" to be 50 to 100 percent of the maximum PM concentration. RLR's many years of experience with PM CEMS correlation testing is to equate "maximum PM concentration" with the PM emission limit.
[6] 88 Fed. Reg. at 24,857.

operate at the "target compliance level," which is 50 percent of the emission limit, (0.005 lb/10^6 Btu) we then have a unit operating at 3.75 mg/acm with an equivalent emission limit of 7.5 mg/acm. Not only will it be virtually impossible to conduct correlation testing at three PM concentrations (low, mid and high), it is far from clear that any type of valid PM CEM correlation can be established over such a limited data range. Using 7.5 mg/acm as the emission limit: low becomes 0 to 3.75 mg/acm; mid is 1.88 to 5.63; and high is 3.75 to 7.5 mg/acm. Anyone who believes he or she can regulate and control PM emissions from a coal-fired EGU that precisely has never set foot in such a facility. If EPA finalizes the MATS fPM limit to 0.010 lb/10^6 Btu, there is a much stronger technical argument to eliminate PM CEMS as a compliance option altogether and rely on quarterly stack testing with longer run times for all EGUs.

EPA states that 3-hr stack testing runs are the solution to minimizing both costs and uncertainty associated with the proposed lower fPM emission limit. While 3-hr testing runs may be acceptable for a standard compliance test that consists of three independent test runs, it is quite unreasonable for either PS-11 initial correlation tests and/or response correlation audits (RCAs). As noted above, PS-11 correlation testing requires a minimum of 15 runs and allows the owner/operator to discard up to five runs to improve correlations. Thus, it is not unusual to conduct 20 test runs for the PS-11 initial correlation test. [7]

A 20-run test program with 3-hr test runs will require on the order of 2 weeks. This is an excessive amount of time to take a unit off dispatch and hold constant load conditions for the sake of testing. How ironic it would be to displace renewable generation with a coal-fired EGU for 2 weeks simply to complete EPA-required testing. The increase in stack testing cost will be significant. [8] Granted, longer test runs improve Method 5 accuracy at low PM concentrations. However, longer test runs will neither expand the range of the data nor the quality of the resulting PM CEMS correlations. The range of the data will be limited even with longer test runs, and the robustness on any resulting correlation will be questionable.

Portland Cement Argument

EPA acknowledges that in the 2012 Portland Cement rulemaking, the Agency was aware of the difficulty in using PM CEMS to demonstrate compliance with a fPM emission limit in the range of 5 to 8 mg/dscm.[9] In the MATS RTR proposal, EPA attempts to dismiss comparisons to the Portland Cement rule by asserting that the particle characteristics between the two source categories are different. We agree that the particle

[7] The RCA requires a minimum of 12 individual runs, and also allows owners/operators to discard up to five runs. Thus, 17 individual runs are often performed for an RCA.
[8] RLR Consulting obtained a budgetary cost estimate of $80,000 for conducting PS-11 correlation test with the proposed sample volume requirement of 4 dscm. The budgetary estimate is $30,000 for conducting PS-11 correlation test under the current MATS requirements.
[9] The Portland Cement fPM emission limit is expressed in the units of pounds of particulate per ton of clinker produced. Thus, the conversion to PM concentration (mg/dscm) is not exact but depends on plant-specific parameters.

characteristics may indeed be different; however, 5 to 8 mg/dscm is a low PM concentration regardless of the size, shape, or constituency of the particles.

EPA addressed its concerns in the Portland Cement rule by (1) increasing the emission limit to a range of 7 to 14 mg/dscm, and (2) no longer requiring PM CEMS to demonstrate compliance with the emission limit. If the real problem were, as EPA now claims, (i.e., 1-hr test runs "led to inherent measurement uncertainty"), we initially wondered why EPA did not simply increase the run times as the Agency is proposing to do in the MATS rule? Further research reveals that EPA did examine the effect of longer run times in 2012 Portland Cement rule. However, EPA recognized then that longer run times would not solve the problem created by a very limited data range for the correlation testing associated with a very low emission limit.[10] The Agency correctly concluded that reference method measurement uncertainty coupled with a limited data range would make establishing a meaningful PM CEMS correlation curve next to impossible.

As noted earlier, PS-11 specifies the correlation requirements that are applicable to PM CEMS. To satisfy PS-11, the PM CEMS correlation must meet the following statistical criteria:

- The correlation coefficient shall be ≥ 0.85.
- The confidence interval (95%) half range at the median PM CEMS response value must be within 10% of the PM emission limit value.[11]
- The tolerance interval half range at the median PM CEMS response value must have 95% confidence that 75% of all possible values are within 25% of the PM emission limit value.

These PS-11 statistical considerations coupled with the low proposed emission limit clearly played a role in EPA's final decision to forego PM CEMS in the Portland Cement rulemaking. In the final Cement rule, EPA states[12]

> A particular challenge in applying PM CEMS to source emissions monitoring is in measuring the very low PM concentrations associated with a low applicable emissions limit for PM precisely enough to meet the PS 11 correlation requirements. In addition to measurement uncertainty inherent in PM CEMS data, the measurement uncertainty associated with the reference test method (e.g., Method 5) is a significant contributor to successful development of a PM CEMS correlation regardless of the type of PM CEMS used.

[10] 77 Fed. Reg. 42,368, 42374 (July 18, 2023).
[11] PS-11 states that the points at which the confidence interval and tolerance interval half ranges are evaluated are a function of the form of the regression equation. For linear and logarithmic correlations, the half intervals are evaluated at the mean PM CEMS response.
[12] 77 Fed. Reg. at 42,374.

As noted above, PS 11 specifies acceptable criteria for a correlation directly related to the applicable emissions limit. If we use 7.5 mg/acm for EPA's proposed fPM limit of 0.010 lb/10^6 Btu,[13] the 95% confidence interval would have to be less than or equal to 0.75 mg/acm. Likewise, the tolerance interval would have to be less than or equal to 1.88 mg/acm. We are not aware of any data or technical support that any commercially available PM CEMS is capable of meeting these very tight confidence and tolerance intervals, and EPA cites none. Adding to the challenge of achieving these strict confidence and tolerance intervals is the fact that these intervals will be at or near the method detection limit of the EPA Method 5, even with extended run times. While PS-11 ascribes all of the measurement errors to the PM CEMS, variability in reference method measurements at these low PM concentrations will likely result in numerous PS-11 failures.

PM CEMS and New EGUs

EPA appears to dismiss concerns with PM CEMS measurements at the low PM concentrations that would be required by the proposed emission standard (0.010 lb/10^6 Btu) by stating: (1) PM CEMS are mandated for new EGUs and (2) the revised fPM emission standards for existing EGUs and the fPM for new EGUs are approximately the same (0.010 lb/10^6 Btu v. 0.090 lb/MWh).[14] We have two issues with EPA's use of new EGUs to support PM CEMS at low concentrations.

Assuming PM CEMS are required for new EGUs, EPA's claim is without merit because PM CEMS are not and have never been demonstrated on new EGUs. The reality is there are no new EGUs in operation, and there is never likely to be one. Apparently, EPA agrees because in the Agency's recently signed proposed rule for controlling greenhouse gas emissions from the power sector, EPA explains not revising the NSPS for newly constructed fossil-fuel-fired steam generating units with the following sentence: "[t]his is because the EPA does not anticipate that any such units will construct or reconstruct and is unaware of plans by any companies to construct or reconstruct a new coal-fired EGU."[15] Supporting the proposed use of PM CEMS at low fPM concentrations by stating the requirement is consistent with a theoretical requirement for new EGUs that have not been built and will never be built is no support at all.

Discussion of PM CEMS Costs

EPA's statement, "not all EGU owners or operators chose the most cost-effective means of demonstrating compliance with the fPM emission limits"[16] is as insulting as it is incorrect. In 2015, we were asked by an EGU owner to estimate the cost over a 10-year

[13] Base on a stack CO_2 concentration of 12.5% (wet basis) and a PM CEMS detector temperature of 320 ° F.
[14] For the MATS rule, a new EGU is defined as one that commenced construction after May 3, 2011.
[15] 88 Fed. Reg. 33,245 (May 23, 2023).
[16] 88 Fed. Reg. 24,872 (April 24, 2023).

period of demonstrating compliance with the MATS fPM emission limit based on (1) quarterly stack testing and (2) PM CEMS. For stack testing, we estimated a total cost of $260,000 (i.e., 10 yr. x 4 quarters x $6,500). The 10-year cost for PM CEMS was $479,500. The PM CEMS estimate included $90,000 capital (representative of an extractive light scatter instrument), $35,000 for initial PS-11 correlation test, $90,000 for three response correlation audits (RCA), $45,500 for seven relative response audits (RRA), and about $20,000 per year for routine maintenance and spare parts. Note that our PM CEMS estimate did not include the cost of three PM spiking events, which would significantly increase the cost of the PM CEMS option. Also, neither cost estimate assumed 3-hr test runs. Longer test runs will increase the cost of quarterly stack tests; however, we believe the cost increase would be greater for PM CEMS because so many more test runs are involved.

We also disagree with EPA statements regarding stack testing costs. EPA states, "annual cost for M5 testing with 3 hour run duration is estimated to be $85,127 ($82,000 for testing, and $3,127 for 24 hours of site technical support); quarterly testing using M5I with runs of similar duration is estimated to be $107,127."[17] RLR obtained a cost estimate of $38,000 from a stack testing company to conduct four quarterly stack tests and collect a minimum sample volume of 4 dscm for each run. EPA digs a deeper hole with its absurd M5I annual estimate of $107,127. As a threshold matter, M5I is not allowed under the MATS rule because M5I specifies a probe and filter temperature of 250 ° F whereas the MATS rule requires a probe and filter temperature of 320 ° F. Assuming EPA were to correct this technical oversite, EPA could never explain how M5I testing would or should cost $22,000 more per year than M5 testing. In other words, EPA grossly inflates its stack testing cost estimates in attempting to make PM CEMS appear more palatable.

Qualitative Aerosol Generator

EPA is correct in stating that for several years the Electric Power Research Institute (EPRI) funded research associated with the development of the Qualitative Aerosol Generator (QAG). The QAG could generate particles of uniform size distribution at precisely known concentrations. The QAG contained components (i.e., mass flow meter) whose calibrations were traceable to the National Institute of Standards and Technology (NIST). However, it was never clear whether the PM aerosol concentration could be shown to be "NIST traceable."

More importantly, EPRI ceased funding QAG research circa 2018. Among the reasons for stopping the research were (1) the field tests had become increasingly complex and expensive and (2) utility-funders lost interest primarily because of EPA's lack of response despite several attempts by EPRI to get EPA involved in a project that sought to make PM CEMS correlations more efficient. We find it incredulous that EPA would dredge up an EPRI project that the Agency never showed any support for and attempt to use that defunct project to support this rulemaking proposal.

[17] Ibid at 24873.

EPA Random Error Memo

EPA states that the impact of sampling times and random errors on measurable emission limits is described in a memorandum in the docket.[18] The Memorandum statement, "2 mg/dscm for a one-hour test run (which is equivalent to a mass per heat input value of 0.0082 lb/mmBtu)," is simply incorrect. A fPM concentration of 2 mg/dscm is approximately 0.0021 lb/10^6 Btu assuming nominal CO_2 concentration of 10.5 % (dry).

The following Memorandum statement "one can calculate the range of the contribution of random error to the total PM CEMS tolerance to be between thirty-six and seventy-three percent" may or may not be incorrect. The Memorandum provides neither a reference nor a method for how random error is defined or calculated. Likewise, there are no text or equations to support the results shown in Table 1. Frankly, the Agency should be embarrassed to include in a rulemaking docket a 2-page Memorandum that is so poorly explained or substantiated.

CONCLUSIONS

First, RLR is not certain the RTR process affords EPA the latitude to make changes to compliance determination procedures. However, as discussed above, the technical justification for mandating PM CEMS, especially if EPA were to lower significantly the fPM standard (as it currently has proposed) is deeply flawed and fraught with several incorrect or inaccurate statements, both concerning the ability to obtain meaningful correlations over a limited data range and the cost of PM CEMS. Thus, for the reasons explained in this memorandum, EPA would be well advised to maintain the quarterly stack testing option for fPM in its MATS rule. Moreover, if EPA were to lower the fPM limit to 0.01 lb/10^6 Btu, EPA should follow the precedent the Agency set in the Portland Cement rule and withdraw PM CEMS as a compliance testing option. Periodic, quality stack tests will be a much better indicator of compliance than continuous data of questionable quality.

If you have any questions regarding our technical comments or require additional information, please do not hesitate to contact me (919) 696-7008 or rlph.roberson@gmail.com.

[18] "PM CEMS Random Error Contribution by Emission Limit," Docket ID No. EPA-HQ-OAR-2018-0794-0794 (hereinafter "Memorandum").