



U.S. ENVIRONMENTAL PROTECTION AGENCY

OFFICE OF INSPECTOR GENERAL

## *Improving Air Quality*

# **EPA Effectively Screens Air Emissions Data from Continuous Monitoring Systems but Could Enhance Verification of System Performance**

Report No. 19-P-0207

June 27, 2019



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## Abbreviations

ARP	Acid Rain Program
CAMD	Clean Air Markets Division
CEMS	Continuous Emissions Monitoring System
CFR	Code of Federal Regulations
CSAPR	Cross-State Air Pollution Rule
ECMPS	Emissions Collection and Monitoring Plan System
EGU	Electric Generating Unit
EPA	U.S. Environmental Protection Agency
FACT	Field Audit Checklist Tool
NO <sub>x</sub>	Nitrogen oxides
OIG	Office of Inspector General
QA	Quality Assurance
QC	Quality Control
RATA	Relative Accuracy Test Audit
SO <sub>2</sub>	Sulfur Dioxide

**Cover photos:** *Clockwise, from top left:* Typical coal-fired power plant, continuous emissions monitoring analyzers, continuous emissions monitor and stack flow monitor.  
(EPA photos)

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# At a Glance

## Why We Did This Project

We conducted this audit to determine whether selected continuous emissions monitoring data meet applicable quality assurance and quality control criteria.

Continuous emissions monitoring systems (CEMSs) are required under some U.S. Environmental Protection Agency (EPA) regulations and programs to continuously monitor actual emissions from stationary sources. Two programs that require the use of CEMSs are the Acid Rain Program (ARP) and the Cross-State Air Pollution Rule (CSAPR), which are intended to reduce emissions of sulfur dioxide and nitrogen oxides. These emissions trading programs are designed to improve air quality by setting emissions limits and monitoring emissions from power plants. It is important that the CEMS data reported to the EPA be accurate and meet regulatory requirements because these data are used to assess compliance with trading program emission limits and progress toward environmental goals.

### This report addresses the following:

- *Improving air quality.*

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## *EPA Effectively Screens Air Emissions Data from Continuous Monitoring Systems but Could Enhance Verification of System Performance*

### What We Found

The EPA's automated screening of facility-reported CEMS data worked as intended and was effective in verifying the quality of the reported data. However, we found a small number of inaccuracies and inconsistencies in the reported data. While these instances had no impact on whether the data met quality assurance requirements, the inaccurate data could have a negative impact on data users by providing inaccurate or misleading information. The EPA can prevent these problems by adding specific screening checks to its existing reporting software.

**Data from CEMS are used to determine whether sources, such as power plants, comply with emissions limits designed to improve air quality and achieve environmental and public health goals.**

Although the EPA's automated screening process was effective, the validity of the reported data can only be fully established when that process is supplemented with on-site field audits to verify that CEMS monitoring requirements were met. However, we found that the EPA and state agencies conducted a limited number of these audits. Out of over 1,000 facilities subject to ARP and/or CSAPR requirements, the EPA conducted field audits at only 16 facilities between 2016 and the end of June 2018. In addition, nine of the 10 state agencies we contacted were not conducting field audits. In response to our work, the EPA initiated a process to develop a streamlined CEMS field audit approach that state and local agencies can use when conducting other on-site visits at facilities.

### Recommendations and Planned Agency Corrective Actions

We recommend that the Assistant Administrator for Air and Radiation develop and implement electronic checks to retroactively evaluate CEMS data where monitoring plan changes have occurred, and develop and distribute to state and local agencies a streamlined field audit process. The EPA agreed with our recommendations and provided acceptable corrective actions and completion dates. All recommendations are considered resolved with corrective actions pending.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
WASHINGTON, D.C. 20460

OFFICE OF  
INSPECTOR GENERAL

June 27, 2019

**MEMORANDUM**

**SUBJECT:** EPA Effectively Screens Air Emissions Data from Continuous Monitoring Systems but Could Enhance Verification of System Performance  
Report No. 19-P-0207

**FROM:** Charles J. Sheehan, Deputy Inspector General

A handwritten signature in blue ink that reads "Charles J. Sheehan".

**TO:** William Wehrum, Assistant Administrator  
Office of Air and Radiation

This is our report on the subject audit conducted by the Office of Inspector General (OIG) of the U.S. Environmental Protection Agency (EPA). The project number for this audit was OA&E-FY18-0181. This report contains findings that describe the problems the OIG has identified and corrective actions the OIG recommends. This report represents the opinion of the OIG and does not necessarily represent the final EPA position. Final determinations on matters in this report will be made by EPA managers in accordance with established audit resolution procedures.

The Office of Air and Radiation's Clean Air Markets Division is the office responsible for the issues discussed in this report.

In accordance with EPA Manual 2750, your office provided acceptable corrective actions and milestone dates in response to OIG recommendations. All recommendations are resolved and no final response to this report is required. However, if you submit a response, it will be posted on the OIG's website, along with our memorandum commenting on your response. Your response should be provided as an Adobe PDF file that complies with the accessibility requirements of Section 508 of the Rehabilitation Act of 1973, as amended. The final response should not contain data that you do not want to be released to the public; if your response contains such data, you should identify the data for redaction or removal along with corresponding justification.

We will post this report to our website at [www.epa.gov/oig](http://www.epa.gov/oig).

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# Chapter 1

## Introduction

### Purpose

The Office of Inspector General (OIG) for the U.S. Environmental Protection Agency (EPA) conducted this audit to determine whether selected continuous emissions monitoring data meet applicable quality assurance (QA) and quality control (QC) criteria.

### Background

Continuous emissions monitoring involves sampling emissions at pollution sources on an ongoing, or continuous, basis. A continuous emissions monitoring system (CEMS) measures actual emissions levels from a stationary source and includes all equipment required to continuously sample, analyze and provide a permanent record of stack emissions. CEMSs are required under some EPA regulations and programs for either continual compliance determinations or determinations of exceedances of the emissions standards. Two EPA programs that require continuous emissions monitoring are the Acid Rain Program (ARP) and the Cross-State Air Pollution Rule (CSAPR).

#### ***EPA Acid Rain Program and Cross-State Air Pollution Rule***

The ARP and CSAPR are emissions trading programs designed to reduce emissions of sulfur dioxide (SO<sub>2</sub>) and nitrogen oxides (NO<sub>x</sub>). Both programs apply to large electric generating units (EGUs) that burn fossil fuels to generate electricity for sale (i.e., power plants).

#### **Affected units under ARP and CSAPR in 2015**

##### **ARP**

- 3,520 EGUs at 1,226 facilities subject to SO<sub>2</sub> requirements.
- 795 EGUs at 336 facilities subject to NO<sub>x</sub> requirements.

##### **CSAPR**

- 2,820 affected EGUs at 864 facilities in SO<sub>2</sub> program and NO<sub>x</sub> annual program.
- 3,228 affected EGUs at 946 facilities in NO<sub>x</sub> ozone season program.

*2015 Program Progress – Cross-State Air Pollution Rule and Acid Rain Program.*

The ARP, established under Title IV of the 1990 Clean Air Act Amendments, requires major emissions reductions of SO<sub>2</sub> and NO<sub>x</sub>—the primary precursors of acid rain—from power plants.

CSAPR requires certain states in the eastern half of the United States to improve air quality by reducing SO<sub>2</sub> and NO<sub>x</sub> power plant emissions that cross state lines and contribute to pollution in downwind states. These improvements help

### Emissions trading programs

Emissions trading, sometimes referred to as “cap and trade” or “allowance trading,” is an approach to reducing pollution.

Emissions trading programs work by first setting a national or regional limit on the overall amount of pollution that sources can emit to the environment. Affected sources included in the trading program, such as power plants, then receive allowances that authorize a certain amount of pollution. For example, in the ARP, each allowance authorizes a source to emit one ton of SO<sub>2</sub>. A source can decide whether to use an allowance for compliance, sell it to another source, or save the allowance for compliance in the future.

To be in compliance, a source must hold enough allowances at the end of a compliance period to account for the amount of pollution it emitted. If all sources are collectively in compliance, total emissions will be at or below the overall emissions limit.

downwind areas attain and maintain EPA health-based air quality standards, known as National Ambient Air Quality Standards.

Thousands of sources nationwide are subject to ARP and/or CSAPR requirements. SO<sub>2</sub> and NO<sub>x</sub> emissions from these sources can contribute to the formation of acid rain, fine particulate matter and ozone, which can negatively impact a person’s respiratory system. Fine particulate matter emissions can also negatively impact people with heart disease and are a main cause of reduced visibility (haze) in many parts of the United States. Both fine particulate matter and acid rain harm sensitive ecosystems such as lakes and forests.

Both the ARP and CSAPR incorporate the use of emissions allowances. Allowances authorize a certain amount of pollution to be emitted by a source and can be bought and sold among sources subject to the programs (“allowance trading”). Emissions must be monitored continuously during the compliance period because emissions allowances are based on

the total mass of a pollutant emitted over a certain time period. Complete and accurate monitoring, reporting and auditing of emissions are key to the EPA’s ability to ensure that the ARP and CSAPR programs function as intended.

### ***Continuous Emissions Monitoring Requirements per 40 CFR Part 75***

Sources subject to the ARP or CSAPR must follow the monitoring regulations in 40 CFR Part 75, which requires continuous monitoring and reporting of SO<sub>2</sub>, carbon dioxide and NO<sub>x</sub> emissions. Most of these emissions are measured with CEMSs, which monitor important information such as the amount of pollution emitted from a smokestack and how fast the emissions occur. Included in 40 CFR Part 75 are requirements intended to:

- Ensure that the emissions from all sources are consistently and accurately measured and reported.
- Produce a complete record of emissions data for each unit subject to the ARP or CSAPR and also subject to Part 75 requirements.



Typical coal-fired power plant; such a facility may have multiple units subject to the ARP, CSAPR and 40 CFR Part 75 monitoring requirements. (EPA photo)

- Ensure that emissions are not underestimated.
- Verify that emissions caps are not exceeded.

Further, 40 CFR Part 75 requires several key ongoing QA/QC tests for CEMSs to ensure the continued accuracy of the emissions data. Three of the tests that are used for CEMSs that measure SO<sub>2</sub> and NO<sub>x</sub> include:

1. *Calibration error tests* compare CEMS data to known reference gas concentrations to determine whether the amount of error in the CEMS data is within acceptable limits established by the EPA. These tests are required to be conducted daily at two reference gas concentrations.
2. *Linearity checks* also compare CEMS data to known reference gas concentrations but do so at three different reference gas concentrations along the full scale of the CEMS (low, mid and high reference gas concentrations). Linearity tests are required to be conducted once each calendar quarter.
3. *Relative accuracy test audits (RATAs)* compare CEMS data to data from independent, EPA-approved emissions monitoring methods (referred to as reference methods). These tests are required to be conducted semiannually or annually.



Stack testers performing a RATA. (EPA photo)

Facilities are required to report electronically to the EPA their monitoring-related data, including a monitoring plan, and results of required QA/QC tests. Facilities report this information to the EPA using an electronic reporting system called the Emissions Collection and Monitoring Plan System (ECMPS). It is important for reported Part 75 CEMS data to be accurate and meet regulatory requirements because these data are used to assess compliance with trading program emissions limits and progress toward environmental goals. Accurate data are also important to verify the integrity of the allowances that are bought and sold under the cap and trade

programs. EPA staff told us that the agency places a high priority on accounting for all emissions and has developed a “comprehensive, holistic” approach to overseeing the quality of Part 75 data.

### ***EPA Process for Verifying CEMS Data Quality***

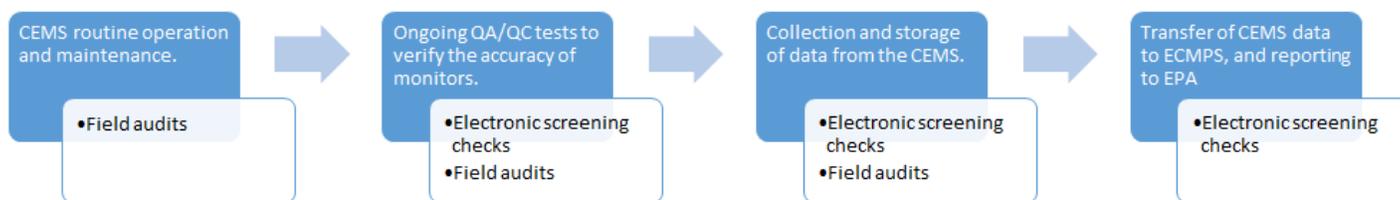
The data quality process for a CEMS includes several activities spanning from the operation of the system at the source facility to the reporting of data to the EPA. These include proper maintenance and operation of the CEMS, required QA/QC tests to verify the accuracy of the monitors, recording and storing electronic

monitoring and operating data, and reporting CEMS data to the EPA. The integrity of the emissions trading programs can break down anywhere along the QA chain of activities, and thus the EPA uses a combination of electronic and field auditing to verify the overall integrity of the emissions monitoring data. The EPA’s Clean Air Markets Division (CAMD), which administers the ARP and CSAPR programs, undertakes several types of activities to oversee the quality of facility-reported CEMS data, including:

- Requiring that affected sources report complete data using the detailed electronic formatting reports in the ECMPS.
- Automated screening of facility-reported CEMS data, with electronic QA checks that are programmed into the ECMPS.
- Statistical analyses, ad-hoc QA checks and desk audits performed by CAMD staff on the reported data from the ECMPS.
- Field audits, which are conducted on-site to verify a facility’s CEMS performance and compliance with monitoring requirements.
- Training and technical assistance for facilities and EPA regional and state/local agency personnel.

We focused our work primarily on the automated screening checks in the ECMPS and on-site field audits. The EPA uses automated screening checks to verify data quality once the data from the CEMS have been recorded and/or reported to the EPA, while field audits are used to verify on-site conditions and performance of the CEMS. Figure 1 provides an overview of where in the process the EPA uses automated screening checks and field audits to oversee CEMS data quality.

**Figure 1: Areas where EPA uses automated checks and field audits to oversee the quality of CEMS data**



Source: OIG analysis.

## Responsible Office

CAMD, within the Office of Air and Radiation, manages programs that reduce air pollution from power plants to address several environmental problems. These include programs to address acid rain, ozone and particle pollution, and the movement of air pollution across state lines. Programs that CAMD is responsible for include the ARP and CSAPR. As such, CAMD is also responsible for assuring the quality of monitoring data reported under these programs.

## Scope and Methodology

We conducted our audit from April 2018 through May 2019 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our objective. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our objective.

To determine whether selected CEMS data meet applicable QA/QC criteria, we evaluated both the automated screening and the field audit aspects of the EPA's QA process through a review of monitoring data, field audit reports, and requests for information from EPA regions and state agencies.

To evaluate the automated data screening process, we selected a sample of units subject to ARP and/or CSAPR that had CEMSs in place to monitor both NO<sub>x</sub> and SO<sub>2</sub>. The team identified a universe of 725 affected units subject to the EPA's ARP or CSAPR that used CEMSs to monitor for both SO<sub>2</sub> and NO<sub>x</sub> emissions under 40 CFR Part 75 monitoring requirements. From this universe, we reviewed 77 randomly selected units.<sup>1</sup> We then reviewed data reported to the ECMPS for the CEMSs in our sample to determine whether the CEMSs were meeting key QA requirements and the data were consistent with selected EPA reporting instructions.

For the units in our sample, we obtained emissions monitoring and applicable QA data that were collected and reported to the EPA between January 1, 2016, and March 31, 2018. Most data were obtained from the EPA's Field Audit Checklist Tool (FACT). FACT is a publicly available Windows desktop application that allows users to easily view monitoring plans, and QA and emissions data that are reported to the ECMPS by sources subject to Part 75 monitoring requirements. Data for linearity checks and RATAs were provided to the OIG by CAMD directly from the ECMPS.

We evaluated the data to determine whether the CEMSs operating on units in our sample were meeting certain QA requirements for relative accuracy, quarterly linearity checks and daily calibration.<sup>2</sup> Where monitors did not meet required performance specifications for these elements, we reviewed monitoring data to determine whether the data were properly characterized to reflect periods where CEMSs were not meeting QA requirements. Additionally, we verified reported test results against the supporting data associated with the test (i.e., a test labeled

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<sup>1</sup> We randomly selected 85 units for review but found that eight of those units were no longer operating. These units were removed from our sample, and we reviewed the remaining 77 units.

<sup>2</sup> 40 CFR Part 75 includes requirements for six main QA tests: calibration error tests, interference checks, flow-to-load ratio, leak checks, linearity checks and RATAs. We chose not to focus on interference checks, flow-to-load ratio or leak checks because these checks are used to test flow monitors. We were primarily focused on QA tests for SO<sub>2</sub> and NO<sub>x</sub> concentration monitors.

as passing included results to support that characterization), checked to see whether appropriate values were reported with test results, and verified certain calculations used to determine compliance with QA performance specifications.

To evaluate the field audit component of the EPA's oversight process for reviewing CEMS data quality, we requested that the EPA provide to us all field audits conducted by CAMD or its contractor from January 1, 2016, through March 31, 2018. We reviewed these audit reports to identify the types of findings and recommendations being made in the audits. Additionally, we obtained results for CAMD's Targeting Tool for Field Audits<sup>3</sup> for each quarter from January 1, 2016, through March 31, 2018. Based on the Targeting Tool for Field Audits results, we identified a sample of 12 facilities and contacted CAMD, EPA regions and state agencies to determine whether any facilities in our sample had been audited.

## Prior OIG Report

Our office has not previously conducted any audits that directly addressed whether CEMS data were meeting QA/QC requirements. However, we reported in September 2009<sup>4</sup> that the EPA did not have reasonable assurance that the gases used to calibrate emissions monitors for the ARP and continuous ambient monitors for the nation's air monitoring network were accurate. We recommended that the Office of Air and Radiation implement oversight programs to assure the quality of the EPA protocol gases used to calibrate CEMSs and also that the EPA's Office of Research and Development update and maintain the protocol gas procedures. In response to the report, the Office of Air and Radiation promulgated a final rule establishing a largely self-supported Protocol Verification Gas Program<sup>5</sup> and implemented a plan to have laboratories conduct routine protocol gas verification activities and communicate results to the EPA.

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<sup>3</sup> The Targeting Tool for Field Audits, developed by CAMD and its contractor, identifies potential candidates for field audits based on eight data-quality-related factors.

<sup>4</sup> Report No. [09-P-0235](#), *EPA Needs an Oversight Program for Protocol Gases*, issued September 16, 2009.

<sup>5</sup> Protocol Gas Verification Program and Minimum Competency Requirements for Air Emission Testing, 76 Fed. Reg. 17288 (Mar. 28, 2011).

## Chapter 2

# EPA Automated Screening of CEMS Data Is Effective but Could Be Enhanced to Reduce Minor Inaccuracies

The EPA’s automated process for screening CEMS data reported to the EPA worked as intended and was effective in verifying the quality of reported data. However, we identified minor inaccuracies in some of the reported data. While these inaccuracies had no impact on whether the data met QA requirements, the inaccurate data could have negative impacts on data users. For example, users could use inaccurate data in independent calculations or could be unable to accurately query the database. The EPA can prevent the inaccuracies by adding specific screening checks to its existing reporting software.

### CEMS Data Electronically Reported and Screened

The EPA’s electronic reporting software for CEMS data—ECMPS—and the built-in QA checks in the software are significant elements of the agency’s process for verifying the quality of data that facilities report to the EPA. CAMD provides the ECMPS software for facilities to submit monitoring plans, QA test results, and emissions and operations data. The software includes thousands of automated QA checks designed to verify that the reported data are complete, properly formatted, mathematically correct, consistent with program requirements, and in accordance with the methods and systems specified in the monitoring plan. For example, for each of the CEMS QA/QC tests we reviewed, the owner/operator reports data from that test along with a test result stating whether the CEMS “passed” or “failed.” The automated ECMPS checks are intended to evaluate whether the QA/QC data reported for the test (“passed” or “failed”) were accurate.

When a facility enters CEMS data into the ECMPS, the ECMPS completes a QA assessment of the data files and generates a feedback report identifying any errors. According to the EPA, errors deemed “critical” by the ECMPS checks must be corrected before the ECMPS allows the data to be submitted to the EPA.

### Electronic Data Quality Checks on Reported Data Worked as Intended

Based on our analyses of data for three key QA/QC tests (daily calibration error checks, quarterly linearity checks and RATAs), we believe the automated screening checks the EPA had in place in the ECMPS were effective in verifying that the reported data met QA requirements. Specifically, we found that:

- All facility-reported test results (“passed” or “failed”) were supported by the underlying QA/QC data.

- Data reported in the ECMPS showed that RATA and linearity checks in our sample were conducted within the time frames required by 40 CFR Part 75.
- Reference gas concentrations for daily calibration error checks and quarterly linearity checks were within required ranges.

Cumulatively, these findings demonstrated that the EPA’s electronic checks were working as intended and were effective in verifying that reported data met key program requirements.

### **Test Results Supported by Underlying Test Data in ECMPS**

We reviewed data in our sample against performance criteria for three key, ongoing QA tests on NO<sub>x</sub> and SO<sub>2</sub> CEMSs that are required by 40 CFR Part 75: daily calibration error checks, quarterly linearity checks and semiannual or annual RATAs. For each of these tests, the EPA identifies performance specifications<sup>6</sup> used to evaluate the acceptability of the CEMSs. CEMSs must meet the performance specifications for valid emissions monitoring data to be reported from the CEMSs. For each test, the EPA provides an alternate performance specification that can satisfy the QA requirements in cases where the primary, or standard, performance specification is not met. If either the standard or alternate performance specification is met, the CEMS is considered to have met the QA requirements and passed the test. Table 1 shows the QA/QC test results for the 77 CEMS units in our sample as they were reported to the ECMPS.

**Table 1: Reported QA/QC test pass/fail rates for CEMS units in our sample**

Test result reported to ECMPS	QA/QC test		
	Daily calibration	Quarterly linearity	Annual/semiannual RATA
Passed	228,779 (98.98%)	2,208 (98.97%)	881 (99.32%)
Failed or aborted	2,353 (1.02%)	23 (1.03%)	6 (0.68%)
<b>Total</b>	<b>231,132 (100%)</b>	<b>2,231 (100%)</b>	<b>887 (100%)</b>

Source: OIG analysis of CEMS data provided by CAMD and/or obtained via EPA’s FACT database.

As shown in Table 1, most of the CEMS QA/QC test results for the units in our sample were reported as passing the performance specifications for the three key QA/QC tests examined. To evaluate whether the ECMPS checks were effective in verifying that these test results were correctly reported by facilities, we used the reported data for each QA/QC test to independently calculate whether the tests met performance specifications and test results were correctly characterized by the reporting facility as either passing or failing. Our review included 231,132 daily calibration error tests, 2,231 linearity tests and 887 RATAs from the

<sup>6</sup> These are thresholds identified by the EPA in 40 CFR Part 75 that define the amount of CEMS measurement error permitted for each QA/QC test.

77 units in our sample. We verified that 100 percent of the reported test results in our sample were supported by the QA/QC test data reported.

### ***Frequency of RATA and Linearity Tests Complied with Required Time Frames***

In addition to the performance specifications required for each QA/QC test, the EPA requires that the tests be conducted at certain intervals or within specific time frames as part of its QA requirements. For the data in our sample, we found semiannual/annual RATA and quarterly linearity check tests were conducted within time frames required by 40 CFR Part 75 in nearly all cases.<sup>7</sup> In rare instances where tests did not occur within required time frames, facilities followed applicable reporting requirements in accordance with 40 CFR Part 75.

### ***Reference Gas Concentrations for Daily Calibration Error Checks and Quarterly Linearity Checks Were Within Required Ranges***

The EPA requires that CEMSs be tested with certified reference gases at certain concentration ranges, depending on the span<sup>8</sup> of the monitor, for both daily calibration error checks and quarterly linearity checks. We reviewed the reported test result data for daily calibration error checks and linearity checks to determine whether the reference gas concentrations for each test met the requirements in 40 CFR Part 75. We found that the reference gas concentrations used for these tests were within the required ranges. However, we found some

instances where incorrect span data were displayed in the FACT database. The data were reported correctly in the ECMPS, and we were also able to verify the correct values in facility monitoring plans. Therefore, these issues did not affect the validity of the data. As a result of our work, CAMD corrected the FACT display issues in an updated version of FACT released on December 17, 2018.



Calibration gas cylinders. (EPA photo)

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<sup>7</sup> We evaluated the time frames for semiannual/annual RATA and quarterly linearity checks in our sample but did not evaluate this aspect of the daily calibration error checks.

<sup>8</sup> *Span* means the highest pollutant or diluent concentration or flow rate that a monitor component is required to be capable of measuring under Part 75. 40 CFR § 72.2.

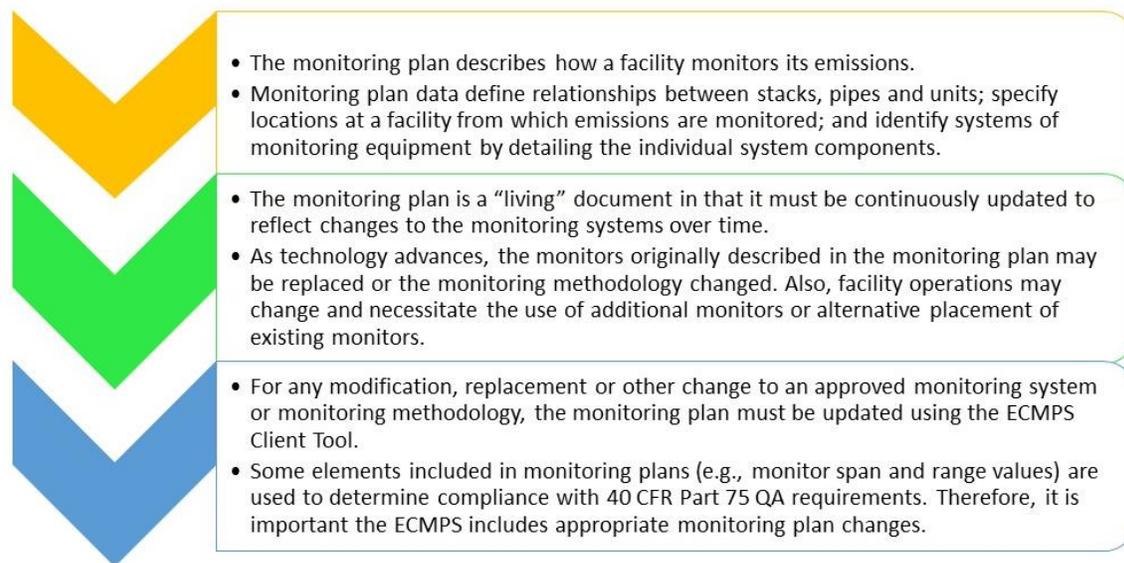
## **EPA Can Enhance Its Data Quality Checks to Reduce Risks of Inaccurate or Inconsistent CEMS Data**

Although the automated screening checks the EPA had in place were effective in verifying that reported data were consistent with key program requirements, we found a small number of inaccuracies and inconsistencies in the reported data that could be improved with enhanced ECMPS checks. In less than 1 percent of the records we reviewed, we found situations where monitor spans reported in the ECMPS did not match the span in the applicable monitoring plan. Also, for approximately 2.4 percent of the QA test records we reviewed, facilities did not accurately report which performance standard a CEMS passed during a required QA test. In both types of situations, the EPA's ECMPS software did not have screening checks in place at the time of our data review that were designed to identify these types of issues. However, CAMD has started implementing corrective actions to address these issues.

### ***Monitoring Plan Changes Were Not Accurately Reflected in a Small Number of Reported Daily Calibration Error Checks***

We found three facilities where a small percentage of reported daily calibration error values were not consistent with independently calculated values—that is, the daily calibration error values reported by these facilities did not match those that the OIG independently calculated based on the monitor span and mean difference values (reference concentration–measured concentration) in the ECMPS. All three facilities reported monitoring data successfully using one set of monitoring plan span records. Span values for each monitor are important because they are used to calculate calibration error. However, through subsequent monitoring plan submissions, the facilities changed the underlying span records that applied to previously reported data. This resulted in inaccurate (old) span values appearing in the ECMPS that did not reflect the updated monitoring plans. When the OIG used the span values in the ECMPS to independently calculate calibration errors, our values did not match the reported values for some daily calibration error results. Figure 2 summarizes the type of information included in facility monitoring plans and why changes to monitoring systems should be updated in monitoring plans and reported to the ECMPS.

**Figure 2: Incorporating monitoring plan changes into ECMPS**



Source: OIG analysis.

CAMD stated that because the span changes in the monitoring plan submissions were made after the evaluation and submission of the emissions file in the ECMPS, it was difficult for the current version of the ECMPS to identify those errors. We found this situation only in a very small number of daily calibration error results that we reviewed (8 out of 231,132, or 0.003 percent). However, because the ECMPS did not identify these types of situations, there is a risk of more data points being subject to this type of error, particularly in a situation where monitoring plan changes applied to more days in a calendar quarter than the specific instances we saw. If the ECMPS is not able to reconcile monitoring plan changes retroactively to applicable data that had been previously submitted, there is a potential risk that the EPA’s automated screening process would not identify certain critical QA and data quality issues.

Based on the OIG’s review, CAMD contacted the facilities to resolve the discrepancies with their reported data and monitoring plans and had them resubmit the applicable data. As of February 2019, all three facilities had resubmitted data to the ECMPS to address the issue. In March 2019, CAMD began implementing a multistep process to identify monitoring plan changes that could affect previously reported data. According to the Chief of CAMD’s Emissions Monitoring Branch, in the long-term, CAMD plans to implement an additional ECMPS check that forces retroactive monitoring plan changes to require the reevaluation and resubmission of any affected QA/QC tests and hourly emissions data. We believe that adding this type of check to the ECMPS should result in the detection of monitoring plan changes (e.g., monitor span values) that will address the inaccuracies we found.

***For a Small Percentage of QA/QC Tests, Facilities Incorrectly Reported Which Performance Standard Was Used to Pass the Test***

A small percentage of QA/QC tests for which the monitors met required performance specifications nonetheless were not accurately labeled in the ECMPS as meeting either the primary or alternate performance specification. As noted above, for each of the three QA/QC tests assessed, the EPA identifies both a standard and alternate performance specification that the CEMS must meet to produce valid data. According to the EPA’s ECMPS reporting instructions, a test result of “PASSED” should be reported when the test was passed using the standard performance specification, and a test result of “PASSAPS” should be reported when the test was passed using the alternate performance specification. Although this was accurately reported for most test results we reviewed, a small percentage of results were reported incorrectly, as shown in Table 2.

**Table 2: QA/QC test results that did not correctly distinguish between passing the standard or alternate performance specification**

QA/QC test	Total test results reviewed	Reported “PASSED” but should have reported “PASSAPS”	Reported “PASSAPS” but should have reported “PASSED”
Daily Calibration Error	231,132	5,720 (2.47%)	0 (0.00%)
Linearity Checks	2,231	0 (0.00%)	1 (0.04%)
RATA	887	5 (0.56%)	3 (0.34%)
<b>Total</b>	<b>234,250</b>	<b>5,725 (2.44%)</b>	<b>4 (0.002%)</b>

Source: OIG analysis of CEMS data provided by CAMD and/or obtained via EPA’s FACT database.

While these situations do not impact the validity of data from the CEMS, they could affect data users who seek to distinguish between the CEMS meeting either the standard or alternate performance standards. As a result of our findings, in March 2019, CAMD implemented a new ECMPS check to address this issue.

**Conclusions**

The EPA’s existing electronic checks worked as intended and were effective in verifying that data as reported to the EPA met minimum quality requirements. However, we found a small number of inaccuracies and inconsistencies in the reported data that, while having no impact on the validity of the data, could provide data users with inaccurate or misleading information. The EPA has taken steps to correct these issues but should finalize a long-term fix to add a check in the ECMPS that forces retroactive monitoring plan changes to require reporting entities to reevaluate and resubmit any affected QA/QC tests and hourly emissions data.

## **Recommendation**

We recommend that that the Assistant Administrator for Air and Radiation:

1. Develop and implement electronic checks in the EPA's Emissions Collection and Monitoring Plan System or through an alternative mechanism to retroactively evaluate emissions and quality assurance data in instances where monitoring plan changes are submitted after the emissions and quality assurance data have already been accepted by the EPA.

## **Agency Response and OIG Evaluation**

The agency concurred with the recommendation and provided an acceptable planned corrective action and completion date. CAMD began implementing a multistep process to identify monitoring plan changes that could affect previously reported data. As a longer-term corrective action, CAMD plans to implement an automated check in the ECMPS requiring facilities to reevaluate and resubmit affected data when facilities make retroactive span record changes. Recommendation 1 is considered resolved with corrective actions pending. Appendix A contains the agency's response to the draft report.

# Chapter 3

## EPA Should Develop a Streamlined On-Site Verification Approach to Maximize State Participation

Although the EPA has an effective system for screening data that facilities report to the EPA on the proper performance of monitoring systems, the EPA and states conducted few field audits and on-site verifications to verify the integrity of that data. The field audit process is critical in verifying proper performance of monitoring systems at facilities subject to 40 CFR Part 75 requirements and identifying problems that could lead to inaccurate emissions reporting. The EPA has limited resources to conduct field audits, and most state agencies contacted were not directly involved in conducting the types of comprehensive field audits identified in the EPA's Part 75 CEMS Field Audit Manual.

### Field Audits and On-Site Verification of CEMS Intended to Verify Performance of CEMS

Field audits consist of activities primarily conducted on-site at a facility to verify that a facility's CEMS is performing properly. The EPA considers field audits a critical part of the process for verifying the quality of facility-reported CEMS data. While the automated screening process described in Chapter 2 focuses on data reported by a facility, a field audit is aimed at evaluating the monitoring process to verify whether it is performing in an optimal manner to produce quality data. The EPA's Part 75 CEMS Field Audit Manual provides recommended procedures and activities to be conducted during an on-site audit. Some of these activities include visually inspecting the monitoring equipment, observing calibration error tests, reviewing physical records including a facility's QA/QC plan, and interviewing facility personnel involved in monitoring.

According to the EPA's Part 75 CEMS Field Audit Manual, the integrity of the emissions trading programs can break down anywhere along the QA chain of activities, and thus the EPA uses a combination of electronic and field auditing to verify the overall integrity of the emissions monitoring data.

There are no requirements in 40 CFR Part 75 for the EPA or state/local air agencies to conduct Part 75 CEMS field audits, but the EPA expects state and local agencies to play an integral role. For example, the EPA's Part 75 CEMS Field Audit Manual states that the "EPA relies on State and local agencies to conduct field audits of monitoring systems to assess the systems performance and a source's compliance with monitoring requirements." Additionally, the Office of Air and Radiation's 2018 National Program Manager guidance states that the EPA expects state and local agencies to "[p]erform electronic and field audits of monitor certifications, Part 75 continuous emissions monitoring systems (CEMS),

and emissions reporting by sources. States and locals should perform Part 75 CEMS field audits in accordance with the field audit manual.”

## **EPA and State Agencies Conducted a Limited Number of Field Audits**

From the start of 2016 to the end of June 2018, CAMD or its contractor conducted Part 75 CEMS field audits at 16 facilities. In 2015 over 1,200 facilities were subject to ARP and Part 75 CEMS requirements. CAMD has allocated limited resources to conduct such audits. In 2016 and 2017, CAMD spent approximately \$60,000 per year to conduct eight and six audits each year, respectively, and approximately \$69,000 to conduct six audits in 2018. According to CAMD’s Chief of the Emissions Monitoring Branch, CAMD expects the amount of funding for field audits to decrease in 2019 and the future.

Despite the EPA’s expectation that state and local agencies play an integral role in conducting field audits, only one of the 10 states we contacted (Michigan) told us it conducts Part 75 field audits. However, even Michigan has not conducted any Part 75 field audits recently; staff from the Michigan Department of Environmental Quality said they have been focused on other requirements in recent years. A manager within the Air Resources Division of another state (New Hampshire) told us that while his staff do not conduct Part 75 audits per se, they conduct onsite activities and verification that are equivalent to (or go beyond) such audits every year at all six affected facilities in the state.

According to CAMD, key reasons why states do not conduct Part 75 field audits are that there are no specific requirements for them to do so and because states face competing priorities. Although CAMD told us that nothing precludes state or local agencies from using Clean Air Act Section 105 grant funds<sup>9</sup> to conduct Part 75 field audits, such audits are not currently included in states’ Section 105 grant commitments with the EPA. According to CAMD, Section 105 grant work plans used to include state and local agency commitments to conduct Part 75 field audits at 10 percent of the applicable facilities in their jurisdictions. However, these commitments were removed sometime between 2004 and 2010.

## **CAMD Targets Audits Based on Several Risk-Based Factors and Has Taken Steps to Better Document Its Selection Procedures**

Due to the limited resources available to conduct field audits, CAMD told us it selects facilities to audit based on several factors. These factors include facilities’ total emissions, operating history, monitoring methodology, control equipment, anticipated retirement date and type of fuel combusted with priority given to coal-burning facilities. CAMD also considers the interest of EPA regions or state/local agencies in a facility, ECMPS errors, and ad-hoc audit results. In addition, CAMD

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<sup>9</sup> Section 105 of the Clean Air Act provides the EPA authority to administer grants to state and local air pollution control agencies to support implementation of Clean Air Act activities.

uses results from its Targeting Tool for Field Audits, which identifies potential candidates for field audits based on eight data-quality-related factors. However, at the time of our fieldwork, the process was not documented in a standard procedure.

We reviewed data from the EPA's Emissions & Generation Resource Integrated Database (known as "eGRID")<sup>10</sup> for the facilities subject to the 16 field audits conducted by CAMD since 2016. We confirmed that these facilities were among those with high electric generating capacity and high annual NO<sub>x</sub> and SO<sub>2</sub> emissions, which CAMD told us are important factors in targeting facilities for audits.

CAMD personnel told us that it would be difficult, given the number of factors considered, to create a standard operating procedure with clear-cut criteria for audit candidate selection. However, in response to our work, CAMD updated its standard operating procedures to include guidance for selecting audit candidates, as well as specific directions for CAMD analysts to document their assessment of the candidate facilities (i.e., explanation for why a facility is or is not a good candidate for a field audit) and provide comments and/or recommendations to the field audit coordinator. We believe it is important to document factors considered and any justifications for choosing an audit candidate. This documentation could help inform future audit candidate selections, particularly in cases where certain factors used in the justification of one audit candidate become linked to specific risks or problems once audits are completed.

## **CAMD Should Develop a Streamlined Approach for On-Site Verification**

While nine out of 10 states we contacted do not conduct full Part 75 field audits, seven states told us that they conduct at least some CEMS-related activities recommended in the EPA's CEMS Field Audit Manual during site visits to conduct Clean Air Act full compliance evaluations. Some states also told us that they review excess emissions and RATA reports and/or observe stack testing or RATAs at facilities. We believe there is an opportunity for CAMD to coordinate with the states to develop guidance and tools to conduct streamlined reviews focusing on the highest-priority activities from the EPA's Part 75 field audit manual. States can then apply a streamlined Part 75 CEMS review process during full compliance evaluations or other onsite visits.

In response to our audit, as of March 2019, CAMD was developing procedures for streamlined or focused audits to be included in the Part 75 Field Audit Manual. The streamlined procedures highlight certain areas of Part 75 CEMSs to review when a comprehensive CEMS audit is not possible. CAMD was in the process of working with states to obtain feedback from the state agencies on the new guidance. We believe CAMD should complete this process of consulting

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<sup>10</sup> The Emissions & Generation Resource Integrated Database is a comprehensive source of data on the environmental characteristics of almost all electric power generated in the United States.

with the states to best assess what activities are the highest priority and the most feasible to include in such a streamlined audit process. In developing this streamlined review process, CAMD should also assess findings and recommendations from its recent field audits to identify any common problem areas at facilities that can be included in the review.

## **Field Audits Can Identify Problems Not Otherwise Detected and Verify that Facilities Submit Valid Data to EPA**

Although limited in number, field audits conducted by CAMD appeared valuable in identifying on-site conditions to improve Part 75 CEMS QA. The 16 field audits CAMD conducted between 2016 and June 2018 resulted in 50 recommendations for facilities to improve their Part 75 monitoring programs. Nearly all these recommendations addressed conditions that would not have been identified without on-site audits. Most findings and recommendations were directed toward updating monitoring and/or QA/QC plans, recording events in maintenance logs, or using proper substitute data procedures.<sup>11</sup>

An Environmental Engineer at CAMD told us that on-site review of facilities' QA/QC plans is an important aspect of field audits. That individual said that although Part 75 requires facilities to develop a QA/QC plan for Part 75 CEMS, these plans are not required to be electronically submitted to the EPA. Therefore, a field audit allows the EPA to verify that QA/QC plans are complete and that the CEMS data reported electronically to the EPA are valid. When on-site audits and verification of CEMS performance are lacking, the EPA does not have adequate confirmation that the CEMSs are being operated in accordance with EPA requirements and generating accurate data.

## **Conclusions**

On-site audits of CEMS implementation and performance are important parts of the QA process for verifying the quality of CEMS data reported to the EPA. However, the EPA conducts a limited number of CEMS field audits, and most state agencies we contacted were not directly involved in conducting comprehensive Part 75 field audits. As a result of our findings, the EPA had taken steps that we believe will help maximize its resources for conducting on-site CEMS audits. These actions included developing documented procedures to improve its processes for (1) tracking field audit recommendations and resulting corrective actions and (2) choosing audit candidates. The EPA could encourage more on-site review and verification of CEMSs by state agencies by providing

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<sup>11</sup>Although these field audits were successful in identifying recommendations, the EPA did not have an effective system in place for tracking these recommendations and resulting corrective actions. In December 2018, CAMD updated its process for tracking audit recommendations and corrective actions based on the OIG's audit. Tracking recommendations and corrective actions could increase the effectiveness, and allow the EPA to better assess the impacts, of the audits that CAMD conducts.

additional guidance so that states can incorporate streamlined on-site reviews of Part 75 CEMSs into their existing on-site visits to facilities.

## **Recommendation**

We recommend that that the Assistant Administrator for Air and Radiation:

2. Develop and distribute to state and local agencies a streamlined field audit process that agencies can use during full compliance evaluations or other onsite visits at facilities.

## **Agency Response and OIG Evaluation**

The agency concurred with the recommendation and provided an acceptable planned corrective action and completion date. CAMD plans to develop a streamlined audit procedure including a pre-audit tool to help state and local agency personnel prepare for an audit. Recommendation 2 is considered resolved with corrective actions pending. Appendix A contains the agency's response to the draft report.

# **Status of Recommendations and Potential Monetary Benefits**

## RECOMMENDATIONS

Rec. No.	Page No.	Subject	Status <sup>1</sup>	Action Official	Planned Completion Date	Potential Monetary Benefits (in \$000s)
1	13	Develop and implement electronic checks in the EPA's Emissions Collection and Monitoring Plan System or through an alternative mechanism to retroactively evaluate emissions and quality assurance data in instances where monitoring plan changes are submitted after the emissions and quality assurance data have already been accepted by the EPA.	R	Assistant Administrator for Air and Radiation	3/31/25	
2	18	Develop and distribute to state and local agencies a streamlined field audit process that agencies can use during full compliance evaluations or other onsite visits at facilities.	R	Assistant Administrator for Air and Radiation	9/30/19	

<sup>1</sup> C = Corrective action completed.  
R = Recommendation resolved with corrective action pending.  
U = Recommendation unresolved with resolution efforts in progress.

## Agency's Response to Draft Report



### UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

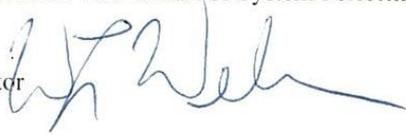
WASHINGTON, D.C. 20460

May 24, 2019

OFFICE OF  
AIR AND RADIATION

#### MEMORANDUM

**SUBJECT:** Response to Office of Inspector General Management Project No. OA&E-FY18-0181, "EPA Effectively Screens Air Emissions Data from Continuous Monitoring Systems but Could Enhance Verification of System Performance"

**FROM:** William L. Wehrum  
Assistant Administrator 

**TO:** James L. Hatfield  
Director, Air Directorate  
Office of Audit and Evaluation

Thank you for the opportunity to review and comment on the Office of Inspector General's (OIG's) report *EPA Effectively Screens Air Emissions Data from Continuous Monitoring Systems but Could Enhance Verification of System Performance*. We appreciate the effort that the OIG has made to alert the Office of Air and Radiation (OAR) to opportunities to enhance the quality of data from continuous emissions monitoring systems (CEMS). We agree with the findings and recommendations identified in the report and are grateful for OIG's engagement and review, as it helped the Clean Air Markets Division (CAMD) make multiple improvements of its systems.

OIG noted that "EPA's electronic checks were working as intended and were effective in verifying that reported data met key program requirements." OIG also noted that CEMS met performance standards approximately 99 percent of the time for the three quality assurance tests that underwent review but that there were some minor inaccuracies in the reported data. OIG acknowledged that these inaccuracies did not affect the validity of the data but could impact data users. CAMD has already made changes to its systems and procedures based on discussions with OIG, and OIG has acknowledged these actions in its report, including:

- Correcting the display of span data in EPA's Field Audit Checklist Tool (FACT) database as of December 2018;
- Adding a new Emission Collection and Monitoring Plan System (ECMPS) check to ensure that the correct labels are applied to quality assurance tests based on whether the test was passed under the primary specification or alternate performance specification as of March 2019; and
- Updating CAMD standard operating procedures (SOPs) to include general criteria for selecting candidate facilities for field audit as of March 2019.

CAMD looks forward to implementing additional actions in response to the two recommendations listed in OIG's report. Below are OAR's responses to OIG's specific recommendations.

**Recommendation 1: Develop and implement electronic checks in the EPA's ECMPS or through an alternative mechanism to retroactively evaluate emissions and quality assurance data in instances where monitoring plan changes are submitted after the emissions and quality assurance data have already been accepted by EPA.**

Response 1: The Office of Air and Radiation agrees with this recommendation. As OIG acknowledged in its report, CAMD has already addressed this issue by implementing a post-submission data check that is run at the end of each reporting period. The new check identifies any monitoring plan submissions containing changes to monitoring span records that occur prior to the current emissions reporting period. If any changes were made, the check recalculates quality assurance tests that were submitted prior to the span change and verifies the pass/fail status of each test. If the status of any test changes, CAMD analysts will contact the affected facility and request the correction and resubmission of the impacted data. As of February 2019, CAMD had insured that the discrepancies in the data used in OIG's review were resolved and resubmitted.

In the long term, CAMD will implement an additional check in the ECMPS forcing retroactive span record changes to require the reevaluation and resubmission of any affected quality assurance tests and hourly emissions records. CAMD has initiated the process of re-engineering ECMPS. In order to minimize additional expenditures on the current version of ECMPS, CAMD will focus on adding the check to the new version of ECMPS.

Planned Completion Date: The post-submission ad-hoc data check will be in operation by the end of Q2 2019. The new ECMPS with the check will be complete by Q1 2025.

**Recommendation 2: Develop and distribute to state and local agencies a streamlined field audit process that agencies can use during full compliance evaluations or other onsite visits at facilities.**

Response 2: The Office of Air and Radiation agrees with this recommendation. Field audits are an important component of the CEMS quality assurance process. In consultation with the states, CAMD has developed a streamlined audit procedure that is included in the revised Field Audit Manual. In addition, CAMD has developed an easy-to-use spreadsheet tool that can be populated with data reported by the facility. This tool will help auditors prepare for an audit and help them quickly identify potential areas for inquiry. The streamlined audit procedure and spreadsheet tool are currently going through peer review by the states.

Planned Completion Date: Both the revised Field Audit Manual with the streamlined audit procedure and the audit spreadsheet tool will be published by the end of Q3 2019.

If you have any questions regarding this response, please contact Jeremy Schreifels, CAMD at (202) 343-9127.

## ***Distribution***

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