



MAPPING QUALITY ASSURANCE REQUIREMENTS FOR CONTINUOUS MERCURY MONITORING SYSTEMS

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INTRODUCTION

The Clean Air Mercury Rule (CAMR) requires coal-fired electric power plants to install and operate mercury continuous monitoring systems by December 31, 2008 such that they will have 12 months of “submittable” data by 1 January 2010. For all practical purposes, “submittable data” are “quality-assured data” that meet the extensive quality control requirements cited in the various regulations that apply to the affected sources.

Regulations governing mercury mass emissions from coal-fired electric generating units are found at 40 CFR Subpart I §75.80-§75.84 and establish mercury monitoring requirements based on mass mercury emission rates as follows:

- Facilities that annually emit more than 29 pounds of mercury must install a continuous monitoring system for mercury.
- Facilities that annually emit 29 pounds of mercury or less, but more than 9 pounds of mercury can conduct semiannual mercury emission testing instead of installing a continuous monitoring system for mercury.
- Facilities that annually emit 9 pounds of mercury or less can conduct annual mercury emission testing instead of installing a continuous monitoring system for mercury.

Although many power plants may opt out of continuous monitoring if emission levels are below the indicated threshold, several hundred continuous mercury monitoring systems (CMMS) will be sold and installed to comply with the federal rules. Furthermore, many states have opposed CAMR in favor of more stringent state regulations. These local initiatives may drive facilities that are exempt from federal continuous mercury monitoring requirements to purchase CMMS.

A review of 40 CFR §75.80-§75.84 indicates that “quality” is referenced 21 times in regard to CMMS. Tracking these primary references leads to six additional sections in 40 CFR §75 with

yet additional references to “quality.” It is important to understand what “quality” means and how it is achieved with respect to CMMS because “submittable data” are the foundation for compliance with the standard and “submittable data” are those that fully satisfy the quality requirements set forth in these regulations.

This paper examines the various references to quality for CMMS, traces references and cross-references, and summarizes the essential quality control requirements for CMMS. Despite the complexity of the discussion of quality within the regulations, this exercise traces quality requirements to two or three key sections, depending on the type of installed CMMS.

QUALITY IS CENTRAL TO CONTINUOUS MERCURY MONITORING SYSTEMS

40 CFR §75.80-§75.84 emphasizes quality because quality control programs help frame measurement certainty. Measurement certainty is a particularly challenging issue for CMMS because measurement levels are exceptionally low and because the data will be used for both compliance demonstration and market trading purposes. With penalties for noncompliance reaching \$25,000 per day for each excess ounce of mercury emission plus future mercury budget surrender at the rate of three to one (1:1 to offset the excess emission plus a 2:1 penalty) and forecasted mercury trading values of \$1,500 per ounce, mercury measurements have significant financial implications for regulated facilities.

“Quality” is used 21 times in 40 CFR §75.80-§75.84 in four broad contexts, as summarized below:

Contextual Use of “Quality”	Example	Frequency
Description of a Type of Testing	“Quality Assurance (QA) Testing” or “QA Relative Accuracy Test Audit”	4 uses
Description of a Type of Data	“Quality Assured Data”	5 uses
Description of a Type of Document	“QA and Quality Control (QC) Records”	6 uses
Quality Specifications or Requirements	Specific Performance Criteria	6 uses

“Quality Assurance Testing” is testing that satisfies quality specifications or requirements. “Quality Assured Data” are those that have been generated in accordance with quality specifications or requirements. “Quality Assurance and Quality Control Records” are those that document or describe conformance to quality specifications or requirements. Thus, “quality” references are traceable to quality specifications or requirements. Interestingly, the “Quality Specifications and Requirements” that are central to all uses of “quality” are not contained in the core regulation but are found in cited regulations depending on mercury measurement technology.

MERCURY MEASUREMENT TECHNOLOGY ESTABLISHES ONE OF TWO SETS OF QUALITY SPECIFICATIONS AND REQUIREMENTS

A complete CMMS consists of a mercury measurement system, a moisture measurement system, a flow measurement system, and a diluent measurement system, which together produce the data necessary for determination of mercury mass emissions based on heat input. There are two basic types of mercury measurement technology:

1. A “mercury concentration measurement system” measures mercury concentration in the source gas directly using integrated analytical instrumentation.
2. A “mercury sorbent trap measurement system” uses a solid sorbent trap to absorb mercury from a sampled stream. The sorbent trap is removed from the sampling system at regular intervals and shipped to a laboratory for analysis. The mercury concentration is then calculated based on the sample volume and absorbed mass of mercury.

Both systems use the same technology for the measurement of moisture, flow, and diluent gases. Data from these associated analytical systems are then used along with measured mercury concentrations to calculate mass mercury emissions and heat input.

Mercury concentration measurement systems are functionally similar to measurement systems for moisture, flow, diluent gases, nitrogen oxides, and sulfur dioxide. Accordingly, the core quality control specifications and requirements for mercury concentration measurement systems are found along with the requirements for measurement systems for moisture, flow, diluent gases, nitrogen oxides, and sulfur dioxide in Appendix B to 40 CFR §75 (Quality Assurance and Quality Control Procedures).

Mercury sorbent trap measurement systems are quite different from continuous emission monitors that make direct concentration measurements of source gas pollutants. For this reason, these systems are subject to unique quality control specifications found in Appendix K to 40 CFR §75 (Quality Assurance and Operating Procedures for Sorbent Trap Monitoring Systems). Appendix K to 40 CFR §75 is actually a method based on EPA Method 324. Quality control requirements are found in Section 8 of Appendix K. Note that while not all mercury sorbent trap CMMS may employ the full suite of moisture, flow, and diluent gas measurement components, when any of these components are in use, the requirements of Appendix B to 40 CFR §75 will apply to those systems.

Thus, there are two key sections that determine quality control requirements and specifications for CMMS:

1. Appendix B to 40 CFR §75 (Quality Assurance and Quality Control Procedures)
2. Appendix K to 40 CFR §75 (Quality Assurance and Operating Procedures for Sorbent Trap Monitoring Systems)

There are, however, additional references to quality in 40 CFR §75.80-§75.84 that seem to imply that there are additional quality requirements for CMMS.

ADDITIONAL QUALITY SPECIFICATIONS AND REQUIREMENTS ARE FOUND IN OTHER SECTIONS OF 40 CFR §75

Regulations that govern both mercury concentration and sorbent trap measurement systems establish QA and QC recordkeeping requirements. The majority of QA and QC documentation requirements are described in Appendix B to 40 CFR §75. Specific requirements for maintaining QA and QC records are found at 40 CFR §75.59 (Certification, Quality Assurance, and Quality Control Record Provisions). In summary, 40 CFR §75.59 requires the source operator to maintain all quality records associated with Appendix B operations or test programs conducted in accordance with Appendix A to 40 CFR §75 (Specifications and Test Procedures).

Mercury concentration measurement systems are also subject to quality requirements set forth in 40 CFR §75.21 (Quality Assurance and Quality Control) and 40 CFR §75.20(d) (Initial Certification and Recertification and Quality Assurance Procedures for Optional Backup Continuous Emission Monitoring Systems). 40 CFR §75.21 references the requirements found in Appendix B to 40 CFR §75 and the quality requirements for redundant CMMS found at 40 CFR §75.20(d). In summary, 40 CFR §75.20(d) establishes identical requirements for primary and redundant CMMS. Thus, 40 CFR §75.21 and 40 CFR §75.20(d) do not establish any new quality requirements beyond those found in Appendix B to 40 CFR §75.

Mercury sorbent trap measurement systems are also subject to quality requirements found at 40 CFR §75.15 (Special Provisions for Measuring Hg Mass Emissions Using the Excepted Sorbent Trap Monitoring Methodology). This section provides references to Sections 1.5 and 2.3 of Appendix B to 40 CFR §75 and Appendix K to 40 CFR §75. Thus, 40 CFR §75.15 does not establish any quality requirements beyond those found in Appendices B and K to 40 CFR §75.

SUMMARY

Regulations found at 40 CFR §75.80-§75.84 lead the reader down a complicated path, with multiple references to quality which in turn produce other references to quality. Tracing these various references indicates that there are three unique references to quality with respect to CMMS:

1. 40 CFR §75.59 establishes quality-related recordkeeping systems. In summary, if an activity is required by Appendix A, B, or K to 40 CFR §75, supporting documentation must be recorded and maintained.
2. Appendix B to 40 CFR §75 establishes QA/QC requirements that apply to both concentration and sorbent trap measurement systems.
 - a. Section 1.1 applies to all CMMS and establishes preventive maintenance, recordkeeping and reporting, and maintenance requirements.
 - b. Section 1.2 applies to mercury concentration measurement systems and establishes requirements for calibration error, linearity checks and adjustments, and relative accuracy audit procedures.
 - c. Section 1.5 applies to sorbent trap monitors and establishes requirements for trap identification and tracking, integrity and data quality, mercury analysis and lab certification, data collection periods, and relative accuracy test procedures.

- d. Section 2 addresses daily, quarterly, semiannual, and annual frequencies for Section 1.2 and Section 1.5 requirements.
3. Section 8 to Appendix K to 40 CFR §75 establishes several QA/QC requirements for sorbent trap monitoring systems including pre- and post-test leak checks; proportional rate sampling; sorbent trap breakthrough; paired trap agreement; spike recovery; analyzer calibration; and dry gas meter and temperature and barometric pressure measurement equipment calibration.

Although the QA and QC requirements found in these three sections are extensive, the fact that all QA and QC requirements are confined to a few sections makes the development and implementation of CMMS quality management systems a straightforward task.