STATE OF MICHIGAN IMPLEMENTATION PLAN
PART 11:
CONTINUOUS EMISSION MONITORING

***DRAFT #1** last reviewed/edited by KJS on April 5, 2013*

Approved SIP	Rules Implemented by State of Michigan	Comments
R 336.2101 Continuous emission monitoring, fossil fuel-fired steam generators. **Rule 1101**. (1) Except as specified in R 336.2199, the owner or operator of any fossil fuel-fired steam generator that has an annual average capacity factor of more than 30%, as reported to the federal power commission for calendar year 1974, or as otherwise determined by the department, shall install, calibrate, maintain, and operate a continuous monitoring system for the measurement of all of the following: (a) Opacity, if the generator has more than 250,000,000 Btu’s per hour heat input, unless gaseous fuel is the only fuel burned, or unless oil or a mixture of gas and oil are the only fuels burned and the source is able to comply with the applicable particulate matter and opacity standards without utilization of particulate matter collection equipment, and where the source has never been found from any administrative or judicial proceedings to be in violation of the applicable visible emission standard. (b) Sulfur dioxide, if the generator has a per hour heat input of more than 250,000,000 Btu’s and if sulfur dioxide emission control equipment	**R 336.2101 Continuous emission monitoring, fossil fuel-fired steam generators.** **Rule 1101**. (1) Except as specified in R 336.2199, the owner or operator of any fossil fuel-fired steam generator that has an annual average capacity factor of more than 30%, as reported to the federal power commission for calendar year 1974, or as otherwise determined by the department, shall install, calibrate, maintain, and operate a continuous monitoring system for the measurement of all of the following: (a) Opacity, if the generator has more than 250,000,000 Btu's per hour heat input, unless gaseous fuel is the only fuel burned, or unless oil or a mixture of gas and oil are the only fuels burned and the source is able to comply with the applicable particulate matter and opacity standards without utilization of particulate matter collection equipment, and where the source has never been found from any administrative or judicial proceedings to be in violation of the applicable visible emission standard. (b) Sulfur dioxide, if the generator has a per hour heat input of more than 250,000,000 Btu's and if sulfur dioxide emission control equipment	**Rule 1101**. Same, except as otherwise noted.

has been installed. (c) Nitrogen oxides if the generator has a per hour heat input of more than 1,000,000,000 Btu’s, is subject to a nitrogen oxides emission standard, and is located in an air quality control region that has been determined by the administrator of the United States environmental protection agency to require a control strategy for nitrogen oxides, unless the owner or operator ~~demonstrates~~, by source emission compliance tests, that the source emits nitrogen oxides at levels 30% or more below the applicable nitrogen oxide emission standard. (d) Oxygen or carbon dioxide percentage, if measurement of oxygen or carbon dioxide in the flue gas is required to convert either sulfur dioxide or nitrogen oxides continuous emission monitoring data to units of the applicable emission standard. (2) The owner or operator of any source subject to subrule (1) of this rule shall complete the installation and performance tests of the equipment required by subrule (1) of this rule and shall begin monitoring and recording within 18 months of the effective date of this rule.	has been installed. (c) Nitrogen oxides if the generator has a per hour heat input of more than 1,000,000,000 Btu's, is subject to a nitrogen oxides emission standard, and is located in an air quality control region that has been determined by the administrator of the United States environmental protection agency to require a control strategy for nitrogen oxides, unless the owner or operator demonstrates, by source emission compliance tests, that the source emits nitrogen oxides at levels 30% or more below the applicable nitrogen oxide emission standard. (d) Oxygen or carbon dioxide percentage, if measurement of oxygen or carbon dioxide in the flue gas is required to convert either sulfur dioxide or nitrogen oxides continuous emission monitoring data to units of the applicable emission standard. (2) The owner or operator of any source subject to subrule (1) of this rule shall complete the installation and performance tests of the equipment required by subrule (1) of this rule and shall begin monitoring and recording within 18 months of the effective date of this rule. History: 1980 AACS; 2002 AACS.	Editorial change.
R 336.2102 Continuous emission monitoring~~,~~ sulfuric acid-producing facilities. ~~(1/18/80)~~ **Rule 1102**. (1) Except as provided in ~~rule 1199~~, the owner or operator of any sulfuric acid plant having a production capacity of more than 300 tons per day, the production capacity being expressed as 100% acid, shall install, calibrate, maintain, and operate a continuous	**R 336.2102 Continuous emission monitoring; sulfuric acid-producing facilities.** **Rule 1102**. (1) Except as provided in R 336.2199, the owner or operator of any sulfuric acid plant having a production capacity of more than 300 tons per day, the production capacity being expressed as 100% acid, shall install, calibrate, maintain, and operate a continuous	Comma replaced by semicolon. Date removed. **Rule 1102**. Same, except as noted. Rule renumbered.

monitoring system for the measurement of sulfur dioxide for each sulfuric acid-producing facility within such plant. (2) The owner or operator of any source subject to the provisions of subrule (1) shall complete the installation and performance tests of the equipment required by subrule (1) and shall begin monitoring and recording within 18 months from the effective date of this rule.	monitoring system for the measurement of sulfur dioxide for each sulfuric acid-producing facility within such plant. (2) The owner or operator of any source subject to the provisions of subrule (1) shall complete the installation and performance tests of the equipment required by subrule (1) and shall begin monitoring and recording within 18 months from the effective date of this rule. History: 1980 AACS.	
	R 336.2103 Continuous emission monitoring, fluid bed catalytic cracking unit catalyst regenerators at petroleum refineries. **Rule 1103**. (1) Except as provided in R 336.2199, the owner or operator of any fluid bed catalytic cracking unit catalyst regenerator at a petroleum refinery having a per day fresh feed capacity of more than 20,000 barrels shall install, calibrate, maintain, and operate a continuous monitoring system for the measurement of opacity. (2) The owner or operator of any source subject to the provisions of subrule (1) shall complete the installation and performance tests of the equipment required by subrule (1) and shall begin monitoring and recording within 18 months from the effective date of this rule. History: 1980 AACS.	**Rule 1103**. This rule was not present on the EPA's website. R 336.2013 was in its place.
	<u>**R 336.2104 Continuous emission monitoring; coal-fired electric generating units at a power plant.**</u> <u>**Rule 1104**. (1) Except as provided in R 336.2160, a unit that serves a generator with a nameplate capacity of more than 25 megawatts</u>	**Rule 1104**. This rule does not have a federal equivalent.

	producing electricity for sale shall install, calibrate, maintain, and operate a continuous monitoring system or a sorbent trap monitoring system for the measurement of mercury. (2) The owner or operator of any source subject to the provisions of subrule (1) of this rule shall complete the installation and performance tests of the equipment required by subrule (1) of this rule and shall begin monitoring and recording within 18 months from the effective date of this rule or by January 1, 2015, whichever is later. History: 2009 AACS.	
R 336.2150 Performance specifications for continuous emission monitoring systems. **Rule 1150**. (1) The monitoring equipment required by R 336.2101, R 336.2102, and R 336.2103 shall be demonstrated by the owners or operators of the monitoring equipment to meet all of the following performance specifications: (a) Continuous monitoring systems for measuring opacity shall comply with performance specification 1 of appendix B to 40 C.F.R. part 60 ~~(2000)~~. (b) Continuous monitoring systems for measuring nitrogen oxides shall comply with performance specification 2 of appendix B to 40 C.F.R. part 60 ~~(2000)~~. (c) Continuous monitoring systems for measuring sulfur dioxide shall comply with performance specification 2 of appendix B to 40 C.F.R. part 60 ~~(2000)~~. (d) Continuous monitoring systems for measuring oxygen shall comply	**R 336.2150 Performance specifications for continuous emission monitoring systems.** **Rule 1150**. (1) The monitoring equipment required by R 336.2101, R 336.2102, R 336.2103, and R 336.2104 shall be demonstrated by the owners or operators of the monitoring equipment to meet all of the following performance specifications: (a) Continuous monitoring systems for measuring opacity shall comply with performance specification 1 of appendix B to 40 C.F.R. part 60 (2007). (b) Continuous monitoring systems for measuring nitrogen oxides shall comply with performance specification 2 of appendix B to 40 C.F.R. part 60 (2007). (c) Continuous monitoring systems for measuring sulfur dioxide shall comply with performance specification 2 of appendix B to 40 C.F.R. part 60 (2007). (d) Continuous monitoring systems for measuring oxygen shall comply	**Rule 1150**. Same, except as noted. R 336.2104 added to list. Dates changed to 2007 throughout.

with performance specification 3 of appendix B to 40 C.F.R. part 60 ~~(2000)~~.	with performance specification 3 of appendix B to 40 C.F.R. part 60 (2007).	
(e) Continuous monitoring systems for measuring carbon dioxide shall comply with performance specification 3 of appendix B to 40 C.F.R. part 60 ~~(2000)~~.	(e) Continuous monitoring systems for measuring carbon dioxide shall comply with performance specification 3 of appendix B to 40 C.F.R. part 60 (2007).	
	(f) Continuous monitoring for measuring stack gas volumetric flow shall comply with the requirements of 40 C.F.R. part 75, §75.20(c) and appendix A and B, or performance specification 6 of appendix B to 40 C.F.R. part 60 (2007).	New section requires compliance with 40 C.F.R. part 75.
	(g) Sorbent trap monitoring system methodology for mercury emission monitoring shall comply with the requirements of R 336.2158.	New section requires compliance with R 336.2158.
	(h) Continuous monitoring systems for measuring total vapor-phase mercury in the flue gas shall comply with the requirements of R 336.2161.	New section requires compliance with R 336.2161.
(2) The performance specifications ~~set forth~~ in subrule (1) of this rule are adopted by reference. Copies of the performance specifications may be inspected at the Lansing office of the air quality division of the department of environmental quality. A copy of title 40 of the Code of Federal Regulations, part 60, appendix B, may be obtained from the Department of Environmental Quality, Air Quality Division, P.O. Box 30260, Lansing, Michigan 48909-7760, at a cost as of the time of adoption of this rule of $~~66.00~~. A copy may also be obtained from the Superintendent of Documents, U.S. Government Printing Office, ~~P.O. Box 371954, Pittsburgh, Pennsylvania 15250-7954~~, at a cost of the time of adoption of this rule of ~~$66.00~~, or on	(2) The performance specifications in subrule (1)(a) through (f) of this rule are adopted by reference. Copies of the performance specifications may be inspected at the Lansing office of the air quality division of the department of environmental quality. The following are adopted by reference: (a) A copy of title 40 of the Code of Federal Regulations, part 60, appendix B, may be obtained from the Department of Environmental Quality, Air Quality Division, P.0. Box 30260, Lansing, Michigan 48909-7760, at a cost as of the time of adoption of this rule of $67.00. A copy may also be obtained from the Superintendent of Documents, U.S. Government Printing Office, P.O.Box 979050, St. Louis, Missouri 63197-9000, at a cost as of	Editorial changes. Editorial changes. Price increased. New address.

the United States government printing office internet web site at ~~http://www.access.gpo.gov.~~	the time of adoption of this rule of $57.00, or on the United States government printing office internet web site at http://www.gpoaccess.gov. (b) A copy of title 40 of the Code of Federal Regulations, part 75, §75.20(c) and appendix A and B, may be obtained from the Department of Environmental Quality, Air Quality Division, P.0. Box 30260, Lansing, Michigan 48909-7760, at a cost as of the time of adoption of this rule of $72.00. A copy may also be obtained from the Superintendent of Documents, U.S. Government Printing Office, P.O. Box 979050, St. Louis, Missouri 63197-9000, at a cost as of the time of adoption of this rule of $62.00, or on the United States government printing office internet web site at http://www.gpoaccess.gov. History: 1980 AACS; 1989 AACS; 2002 AACS; 2009 AACS.	Price decreased. New website. New section gives information on getting copies of 40 C.F.R. part 75.
R 336.2151~~.~~ Calibration gases for continuous emission monitoring systems. ~~(1/18/80)~~ **Rule 1151**. (1) For nitrogen oxide monitoring systems installed on fossil fuel-fired steam generators, the pollutant gas used to prepare calibration gas mixtures shall be nitric oxide. (2) For sulfur dioxide monitoring systems installed on fossil fuel-fired steam generators or sulfuric acid plants, the pollutant gas used to prepare calibration gas mixtures shall be sulfur dioxide. (3) Span and zero gases shall be traceable to national bureau of standards reference gases ~~whenever~~ these reference gases are available. Every 6 months from the date of	**R 336.2151 Calibration gases for continuous emission monitoring systems.** **Rule 1151**. (1) For nitrogen oxide monitoring systems installed on fossil fuel-fired steam generators, the pollutant gas used to prepare calibration gas mixtures shall be nitric oxide. (2) For sulfur dioxide monitoring systems installed on fossil fuel-fired steam generators or sulfuric acid plants, the pollutant gas used to prepare calibration gas mixtures shall be sulfur dioxide. (3) Span and zero gases shall be traceable to national bureau of standards reference gases when these reference gases are available. Every 6 months from the date of	Period removed from state SIP. Date removed from state SIP. **Rule 1151**. Same, except as noted. Editorial change.

manufacture, span and zero gases shall be reanalyzed by conducting triplicate analyses using the reference method in appendix A of 40 C.F.R. part 60 (July 1, ~~1978~~), as follows: (a) For sulfur dioxide, use reference method 6. (b) For nitrogen oxides, use reference method 7. (c) For carbon dioxide and oxygen, use reference method 3. The gases may be analyzed at less frequent intervals if longer shelf lives are guaranteed by the manufacturer.	manufacture, span and zero gases shall be reanalyzed by conducting triplicate analyses using the reference method in appendix A of 40 C.F.R. part 60 (July 1, 1982), as follows: (a) For sulfur dioxide, use reference method 6. (b) For nitrogen oxides, use reference method 7. (c) For carbon dioxide and oxygen, use reference method 3. The gases may be analyzed at less frequent intervals if longer shelf lives are guaranteed by the manufacturer. History: 1980 AACS; 1989 AACS.	Date updated.
R 336.2152~~.~~ Cycling time for continuous emission monitoring systems. ~~(1/18/80)~~ **Rule 1152**. (1) Continuous monitoring systems for measuring opacity shall complete a minimum of 1 cycle of sampling and analyzing for each successive 10-second period and 1 cycle of data recording for each successive 6-minute period. (2) Continuous monitoring systems for measuring oxides of nitrogen, carbon dioxide, oxygen, or sulfur dioxide shall complete a minimum of 1 cycle of operation for each successive 15-minute period.	**R 336.2152 Cycling time for continuous emission monitoring systems.** **Rule 1152**. (1) Continuous monitoring systems for measuring opacity shall complete a minimum of 1 cycle of sampling and analyzing for each successive 10-second period and 1 cycle of data recording for each successive 6-minute period. (2) Continuous monitoring systems for measuring oxides of nitrogen, carbon dioxide, oxygen, or sulfur dioxide shall complete a minimum of 1 cycle of operation for each successive 15-minute period. History: 1980 AACS.	Period removed from state SIP. Date removed from state SIP. **Rule 1152**. Same, except as noted.
R 336.2153 Zero and drift for continuous emission monitoring systems. ~~(1/18/80)~~ **Rule 1153**. (1) The owner or operator of any continuous emission monitoring system required by this part shall do all of the following: (a) Subject the instruments to the manufacturer's recommended zero and span check at least once daily,	**R 336.2153 Zero and drift for continuous emission monitoring systems.** **Rule 1153**. (1) The owner or operator of any continuous emission monitoring system required by this part shall do all of the following: (a) Subject the instruments to the manufacturer's recommended zero and span check at least once daily,	Date removed in state SIP. **Rule 1153**. Same, except as noted.

unless the manufacturer has recommended adjustments at shorter intervals, in which case such recommendations shall be followed. (b) Adjust the zero and span ~~whenever~~ the 24-hour zero drift or 24-hour calibration drift limits of the applicable performance specifications in appendix B of 40 C.F.R. part 60 ~~(July 1, 1978)~~, are exceeded. (c) Adjust continuous monitoring systems purchased ~~prior to~~ September 11, 1974, ~~whenever~~ the 24-hour zero drift or the 24-hour calibration drift exceeds 10% of the applicable emission standard. (2) Calibration gases used pursuant to subrule (1) shall meet the requirements of rule 1151.	unless the manufacturer has recommended adjustments at shorter intervals, in which case such recommendations shall be followed. (b) Adjust the zero and span when the 24-hour zero drift or 24-hour calibration drift limits of the applicable performance specifications in appendix B of 40 C.F.R. part 60 (May 25, 1983), are exceeded. (c) Adjust continuous monitoring systems purchased before September 11, 1974, when the 24-hour zero drift or the 24-hour calibration drift exceeds 10% of the applicable emission standard. (2) Calibration gases used pursuant to the provisions of subrule (1) of this rule shall meet the requirements of R 336.2151. History: 1980 AACS; 1989 AACS.	Editorial change. Date updated. Editorial change. Editorial change. Editorial changes.
R 336.2154~~.~~ Instrument span for continuous emission monitoring systems. ~~(1/18/80)~~ **Rule 1154**. Instrument span shall be approximately 200% of the expected instrument data display output corresponding to the emission standard for the source.	**R 336.2154 Instrument span for continuous emission monitoring systems.** **Rule 1154**. Instrument span shall be approximately 200% of the expected instrument data display output corresponding to the emission standard for the source. History: 1980 AACS.	Period removed in state SIP. Date removed in state SIP. **Rule 1154**. Same, except as noted.
R 336.2155 Monitor location for continuous emission monitoring systems. **Rule 1155**. (1) The owner or operator of a source subject to the ~~provisions~~ of this part shall install the required continuous monitoring systems or monitoring devices such that representative measurements of emissions or process parameters from the affected facility are obtained. (2) When the effluents from 2 or	**R 336.2155 Monitor location for continuous emission monitoring systems.** **Rule 1155**. (1) The owner or operator of a source subject to the provi-sions of this part shall install the required continuous monitoring systems or monitoring devices such that representative measurements of emissions or process parameters from the affected facility are obtained. (2) When the effluents from 2 or	**Rule 1155**. Same, except as noted. Line break in the state SIP.

more affected facilities of similar design and operating characteristics are combined before being released into the atmosphere, the owner or operator of a source subject to the provisions of this part may install monitoring systems on the combined effluent. When the affected facilities are not of similar design and operating ~~characteristics~~, or when the effluent from 1 affected facility is released into the atmosphere through more than 1 point, the owner or operator shall establish alternate procedures to implement the intent of these requirements subject to approval by the department.	more affected facilities of similar design and operating characteristics are combined before being released into the atmosphere, the owner or operator of a source subject to the provisions of this part may install monitoring systems on the combined effluent. When the affected facilities are not of similar design and operating <u>characteris-tics</u>, or when the effluent from 1 affected facility is released into the atmosphere through more than 1 point, the owner or operator shall establish alternate procedures to implement the intent of these requirements subject to approval by the department. History: 1980 AACS; 2002 AACS.	Line break in the state SIP.
	<u>R 336.2156 Performance testing notifications; monitoring notification.</u> **<u>Rule 1156</u>**<u>. The owner or operator of any source required to install a continuous emission monitor by R 336.2101, R 336.2102, R 336.2103, or R 336.2104 shall submit to the department all of the following:</u> <u>(a) A source-specific monitoring plan not less than 60 days prior to performance specification testing of the monitoring system for the review and approval of the department.</u> <u>(b) A site-specific test plan not less than 30 days prior to the performance specification testing of the monitoring system for review and approval of the department.</u> <u>(c) All results of performance specification testing not more than 60 days after the last date of the test.</u> History: 2009 AACS.	**Rule 1156.** This rule does not have a federal equivalent.
	<u>R 336.2157 Quality assurance</u>	

	requirements for continuous emission monitoring systems. **Rule 1157**. (1) The monitoring equipment required by R 336.2101, R 336.2102, R 336.2103, and R 336.2104 shall perform continuing quality control procedures in accordance with procedure 1 of appendix F to 40 C.F.R. part 60, adopted by reference in R 336.1802a. Monitors installed and certified in accordance with appendix A to part 75 and meeting the continuing quality control requirements of appendix B to part 75 are exempt from the requirements of procedure 1 of appendix F of part 60. (2) When a mercury CEMS required by R 336.2104 uses elemental mercury (Hg0) for daily calibration and cylinder gas audits, a single point oxidized mercury converter check shall be performed weekly using a national institute of standards and technology (NIST) traceable source of oxidized mercury. The result of the converter check shall not deviate from the reference value by more than 10% or an absolute difference of 0.8 micrograms per standard cubic meter (µg/scm). (3) A continuous stack gas volumetric flow monitor installed for R 336.2104 shall perform continuing quality control in accordance with the applicable quality control and quality assurance requirements of 40 C.F.R.§75.21 and part 75 appendix B, adopted by reference in R 336.1802a or procedure 1 of appendix F of 40 C.F.R. part 60. History: 2009 AACS.	**Rule 1157**. This rule does not have a federal equivalent.

	R 336.2158 Sorbent trap monitoring system methodology for mercury emission monitoring; scope; application. **Rule 1158**. (1) This rule specifies sampling, analytical, and quality-assurance criteria and procedures for the performance-based monitoring of vapor-phase mercury emissions in combustion flue gas streams, using a sorbent trap monitoring system. The principle employed is continuous sampling using in-stack sorbent media coupled with analysis of the integrated samples. The performance-based approach of this method allows for use of various suitable sampling and analytical technologies while maintaining a specified and documented level of data quality through performance criteria. Persons using this method should have a thorough working knowledge of methods 1, 2, 3, 4, and 5 in appendices A–1 through A–3 to 40 C.F.R. part 60, as well as the determinative technique selected for analysis. All of the following apply: (a) Analytes. The analyte measured by these procedures and specifications is total vapor-phase mercury in the flue gas, which represents the sum of elemental mercury (Hg0, CAS Number 7439–97–6) and oxidized forms of mercury, in mass concentration units of micrograms per dry standard cubic meter (µg/dscm). (b) Applicability. These performance criteria and procedures are applicable to monitoring of vapor-phase mercury emissions under relatively low-dust conditions, sampling in the stack after all pollution control devices, from coal-fired electric utility steam generators	**Rule 1158**. This rule does not have a federal equivalent.

	which are subject to R 336.2501 to R 336.2513. Individual sample collection times can range from 30 minutes to several days in duration, depending on the mercury concentration in the stack. The monitoring system shall achieve the performance criteria specified in subrule (5) of this rule and the sorbent media capture ability shall not be exceeded. The sampling rate shall be maintained at a constant proportion to the total stack flow rate to ensure representativeness of the sample collected. Failure to achieve certain performance criteria will result in invalid mercury emissions monitoring data. (c) Principle. Known volumes of flue gas are extracted from a stack or duct through paired, in-stack, pre-spiked sorbent media traps at an appropriate nominal flow rate. Collection of mercury on the sorbent media in the stack mitigates potential loss of mercury during transport through a probe/sample line. Paired train sampling is required to determine measurement precision and verify acceptability of the measured emissions data. (d) The sorbent traps are recovered from the sampling system, prepared for analysis, as needed, and analyzed by any suitable determinative technique that meets the performance criteria. A section of each sorbent trap is spiked with Hg0 prior to sampling. This section is analyzed separately and the recovery value is used to determine the validity of sampling data in accordance with Table 111. (e) Clean handling and contamination. To avoid mercury contamination of the samples,	

	special attention should be paid to cleanliness during transport, field handling, sampling, recovery, and laboratory analysis, as well as during preparation of the sorbent cartridges. Collection and analysis of blank samples, such as field, trip, and lab, is useful in verifying the absence of contaminant mercury. (2) Equipment and supplies: All of the following are examples of key equipment and supplies required to perform vapor-phase mercury monitoring using a sorbent trap monitoring system. Additional equipment and supplies may be needed. Collection of paired samples is required. Also required are a volumetric flow monitor certified in accordance with R 336.2150 and maintained in accordance with R 336.2157, and an acceptable means of correcting for the stack gas moisture content by using data from certified continuous moisture monitoring. A typical sorbent trap monitoring system is shown in figure 1. (a) Sorbent trap monitoring system. The monitoring system shall include the following components: (i) Sorbent traps. The sorbent media used to collect mercury must be configured in a trap with 3 distinct and identical segments or sections, connected in series that are amenable to separate analyses. Section 1 is designated for primary capture of gaseous mercury. Section 2 is designated as a backup section for determination of vapor-phase mercury breakthrough. Section 3 is designated for quality assurance and quality control purposes where this section shall be spiked with a known amount of gaseous Hg0 prior to	

	sampling and later analyzed to determine recovery efficiency. The sorbent media may be any collection material, for example, carbon or chemically-treated filter, capable of quantitatively capturing and recovering for subsequent analysis, all gaseous forms of mercury for the intended application. Selection of the sorbent media shall be based on the material's ability to achieve the performance criteria contained in subrule (5) of this rule as well as the sorbent's vapor-phase mercury capture efficiency for the emissions matrix and the expected sampling duration at the test site. The sorbent media shall be obtained from a source that can demonstrate the quality assurance and control necessary to ensure consistent reliability. The paired sorbent traps are supported on a probe or probes and inserted directly into the flue gas stream. (ii) Sampling probe assembly. Each probe assembly shall have a leak-free attachment to the sorbent trap or traps. Each sorbent trap shall be mounted at the entrance of or within the probe such that the gas sampled enters the trap directly. Each probe/sorbent trap assembly shall be heated to a temperature sufficient to prevent liquid condensation in the sorbent trap or traps. Auxiliary heating is required only where the stack temperature is too low to prevent condensation. A calibrated thermocouple to monitor the stack temperature shall be used. A single probe capable of operating the paired sorbent traps may be used. Alternatively, individual probe/sorbent trap assemblies may be used, provided that the individual	

	sorbent traps are co-located to ensure representative mercury monitoring and are sufficiently separated to prevent aerodynamic interference. (iii) Moisture removal device. A robust moisture removal device or system, suitable for continuous duty, such as a Peltier cooler, shall be used to remove water vapor from the gas stream prior to entering the gas flow meter. (iv) Vacuum pump. Use a leak-tight, vacuum pump capable of operating within the candidate system's flow range. (v) Gas flow meter. A gas flow meter, such as a dry gas meter, thermal mass flow meter, or other suitable measurement device, shall be used to determine the total sample volume on a dry basis, in units of standard cubic meters (scm). The meter shall be sufficiently accurate to measure the total sample volume to within 2% and must be calibrated at selected flow rates across the range of sample flow rates at which the sorbent trap monitoring system typically operates. The gas flow meter shall be equipped with any necessary auxiliary measurement devices, for example, temperature sensors or pressure measurement devices, needed to correct the sample volume to standard conditions. (vi) Sample flow rate meter and controller. Use a flow rate indicator and controller for maintaining necessary sampling flow rates. (vii) Temperature sensor. Follow the procedures in section 6.1.1.7 of method 5 in appendix A–3 to 40 C.F.R part 60, adopted by reference	

	in R 336.2004. (viii) Barometer. Follow the procedures in section 6.1.2 of method 5 in appendix A–3 to 40 C.F.R part 60, adopted by reference in R 336.2004. (ix) Data logger (optional). Device for recording associated and necessary ancillary information, for example, temperatures, pressures, flow, and time. (b) Gaseous Hg0 sorbent trap spiking system. A known mass of gaseous Hg0 shall be spiked onto section 3 of each sorbent trap prior to sampling. Any approach capable of quantitatively delivering known masses of Hg0 onto sorbent traps is acceptable. Several technologies or devices are available to meet this objective. Practicality of these technologies or devices is a function of mercury mass spike levels. Both of the following apply: (i) For low levels, NIST-certified or NIST-traceable gas generators or tanks may be suitable, but may require long preparation times. (ii) An alternative system, capable of delivering almost any mass required, makes use of NIST-certified or NIST-traceable mercury salt solutions (for example, Hg(NO3)2). With this system, an aliquot of known volume and concentration is added to a reaction vessel containing a reducing agent, for example, stannous chloride; the mercury salt solution is reduced to Hg0 and purged onto section 3 of the sorbent trap using an impinger sparging system. (c) Sample analysis equipment. An analytical system capable of quantitatively recovering and quantifying total gaseous mercury	

	from sorbent media is acceptable provided that the analysis meets the performance criteria in subrule (5) of this rule. Candidate recovery techniques include leaching, digestion, and thermal desorption. Candidate analytical techniques include ultraviolet atomic fluorescence (UV AF); ultraviolet atomic absorption (UV AA), with and without gold trapping; and in situ X-ray fluorescence (XRF) analysis. Figure 1. Typical sorbent trap monitoring system [See attached figure] (3) Reagents and standards. Only NIST-certified or NIST-traceable calibration gas standards and reagents shall be used for the tests and procedures required in this rule. (4) The following sample collection and transport procedures are required: (a) Pre-test procedures. (i) Selection of sampling site. Sampling site information should be obtained in accordance with method 1 in appendix A–1 to 40 C.F.R part 60. Identify a monitoring location representative of source mercury emissions. Locations shown to be free of stratification through measurement traverses for gases such as sulfur dioxide and oxides of nitrogen may be an approach. An estimation of the expected stack mercury concentration is required to establish a target sample flow rate, total gas sample volume, and the mass of Hg0 to be spiked onto section 3 of each sorbent trap. (ii) Pre-sampling spiking of sorbent	

	traps. Based on the estimated mercury concentration in the stack, the target sample rate and the target sampling duration, calculate the expected mass loading for section 1 of each sorbent trap. An example calculation is contained in subrule (8)(b) of this rule. The pre-sampling spike to be added to section 3 of each sorbent trap shall be within ± 50% of the expected section 1 mass loading. For each sorbent trap, keep an official record of the mass of Hg0 added to section 3. This record shall include, at a minimum, the ID number of the trap, the date and time of the spike, the name of the analyst performing the procedure, the mass of Hg0 added to section 3 of the trap (microgram or μg), and the supporting calculations. This record shall be maintained in a format suitable for inspection and audit and shall be available to the regulatory agencies upon request. (iii) Pre-test leak check. Perform a leak check with the sorbent traps in place. Draw a vacuum in each sample train. Adjust the vacuum in the sample train to approximately 15 inches mercury. Using the gas flow meter, determine leak rate. The leakage rate shall not exceed 4% of the target sampling rate. Once the leak check passes this criterion, carefully release the vacuum in the sample train, then seal the sorbent trap inlet until the probe is ready for insertion into the stack or duct. (iv) Determination of flue gas characteristics. Determine or measure the flue gas measurement environment characteristics, for example, gas temperature, static pressure, gas velocity, and stack moisture, to determine ancillary	

	requirements such as probe heating requirements, if any, initial sample rate, proportional sampling conditions, and moisture management. (b) Sample collection. (i) Remove the plug from the end of each sorbent trap and store each plug in a clean sorbent trap storage container. (ii) Remove the stack or duct port cap and insert the probe or probes. (iii) Secure the probe or probes and ensure that no leakage occurs between the duct and environment. (iv) Record initial data, including the following: (A) Sorbent trap ID. (B) Start time. (C) Starting dry gas meter readings. (D) Initial temperatures. (E) Set-points and any other appropriate information. (c) Flow rate control. The following apply: (i) Set the initial sample flow rate at the target value pursuant to subrule (4)(a)(i) of this rule. (ii) Record the initial gas flow meter reading, stack temperature, if needed to convert to standard conditions, and meter temperatures, if needed. (iii) For every operating hour during the sampling period, record the following: (A) Date and time. (B) Sample flow rate. (C) Gas flow meter reading. (D) Stack temperature, if needed. (E) Flow meter temperatures, if needed. (F) Temperatures of heated equipment such as the vacuum lines and the probes, if heated. (G) Sampling system vacuum	

	readings. (H) Stack gas flow rate, as measured by the certified flow monitor. (I) Ratio of the stack gas flow rate to the sample flow rate. (J) Adjust the sampling flow rate to maintain proportional sampling, keeping the ratio of the stack gas flow rate to sample flow rate constant, to within ± 25% of the reference ratio from the first hour of the data collection period, as described in subrule (8)(c) of this rule. (iv) The sample flow rate through a sorbent trap monitoring system during any hour, or portion of an hour, in which the unit is not operating shall be zero. (d) Stack gas moisture determination. Determine stack gas moisture using a continuous moisture monitoring system. (e) Essential operating data. Obtain and record any essential operating data for the facility during the test period, for example, the barometric pressure for correcting the sample volume measured by a dry gas meter to standard conditions. At the end of the data collection period, record the final gas flow meter reading and the final values of all other essential parameters. (f) Post test leak check. When sampling is completed, turn off the sample pump, remove the probe/sorbent trap from the port and carefully re-plug the end of each sorbent trap. All of the following apply: (i) Perform a leak check with the sorbent traps in place, at the maximum vacuum reached during the sampling period. Use the same general approach described in	

	subrule (4)(a)(iii) of this rule. (ii) Record the leakage rate and vacuum. The leakage rate shall not exceed 4% of the average sampling rate for the data collection period. (iii) Following the leak check, carefully release the vacuum in the sample train. (g) Sample recovery. Recover each sampled sorbent trap by removing it from the probe and sealing both ends. Wipe any deposited material from the outside of the sorbent trap. Place the sorbent trap into an appropriate sample storage container; store and preserve in appropriate manner. (h) Sample preservation, storage, and transport. While the performance criteria of this approach provides for verification of appropriate sample handling, the user should consider, determine, and plan for suitable sample preservation, storage, transport, and holding times for these measurements. The procedures in the American Society for Testing and Materials (ASTM) D6911–03, “Standard Guide for Packaging and Shipping Environmental Samples for Laboratory Analysis,” adopted by reference in R 336.2502, shall be followed for all samples. (i) Sample custody. Proper procedures and documentation for sample chain of custody are critical to ensuring data integrity. The chain of custody procedures in ASTM D4840–99 (reapproved 2004) “Standard Guide for Sample Chain-of-Custody Procedures,” adopted by reference in R 336.2502, shall be followed for all samples, including field samples and blanks.	

(5) Quality assurance and quality control. Table 111 summarizes the quality assurance and quality control performance criteria that are used to validate the mercury emissions data from sorbent trap monitoring systems, including the relative accuracy test audit (RATA) requirement. Failure to achieve these performance criteria will result in invalidation of mercury emissions data.

Table 111
Quality Assurance/Quality Control Criteria For Sorbent Trap Monitoring Systems

[See attached table]

(6) Calibration and standardization. Only NIST-certified and NIST-traceable calibration standards, for example, calibration gases or solutions, shall be used for the spiking and analytical procedures in these rules.

(a) Gas flow meter calibration. The manufacturer or supplier of the gas flow meter should perform all necessary set-up, testing, programming, and should provide the end user with any necessary instructions to ensure that the meter will give an accurate readout of dry gas volume in scm for the particular field application. The following apply:

(i) Initial calibration. Prior to its initial use, a calibration of the flow meter shall be performed. The initial calibration may be done by the manufacturer, by the equipment supplier, or by the end user. The following apply:

(A) If the flow meter is volumetric in nature, for example, a dry gas

	meter, the manufacturer, equipment supplier, or end user may perform a direct volumetric calibration using any gas. (B) For a mass flow meter, the manufacturer, equipment supplier, or end user may calibrate the meter using a bottled gas mixture containing 12 ± 0.5% carbon dioxide, 7 ± 0.5% oxygen, and balance nitrogen, or these same gases in proportions more representative of the expected stack gas composition. Mass flow meters may also be initially calibrated on-site, using actual stack gas. (ii) Initial calibration procedures. Determine an average calibration factor (Y) for the gas flow meter, by calibrating it at 3 sample flow rate settings covering the range of sample flow rates at which the sorbent trap monitoring system typically operates. Use the procedures in section 10.3.1 or the procedures in section 16 of method 5 in appendix A–3 to 40 C.F.R. part 60 as appropriate. If a dry gas meter is being calibrated, use at least 5 revolutions of the meter at each flow rate. (iii) Alternative initial calibration procedures. Alternatively, the initial calibration of the gas flow meter may be performed using a reference gas flow meter (RGFM). The RGFM may be any of the following: (A) A wet test meter calibrated according to section 10.3.1 of method 5 in appendix A–3 to 40 C.F.R. part 60. (B) A gas flow metering device calibrated at multiple flow rates using the procedures in section 16 of method 5 in appendix A–3 to 40 C.F.R. part 60.	

	(C) A NIST–traceable calibration device capable of measuring volumetric flow to an accuracy of 1%. (iv) To calibrate the gas flow meter using the RGFM, proceed in the following manner: (A) While the sorbent trap monitoring system is sampling the actual stack gas or a compressed gas mixture that simulates the stack gas composition (as applicable), connect the RGFM to the discharge of the system. Care should be taken to minimize the dead volume between the sample flow meter being tested and the RGFM. (B) Concurrently measure dry gas volume with the RGFM and the flow meter being calibrated for a minimum of 10 minutes at each of 3 flow rates covering the typical range of operation of the sorbent trap monitoring system. (C) For each 10-minute, or longer, data collection period, record the total sample volume, in units of dry standard cubic meters (dscm), measured by the RGFM and the gas flow meter being tested. (v) Initial Calibration Factor. The following apply: (A) Calculate an individual calibration factor Yi at each tested flow rate from paragraph (ii) or (iii) of this subdivision, as appropriate, by taking the ratio of the reference sample volume to the sample volume recorded by the gas flow meter. (B) Average the 3 Yi values, to determine Y, the calibration factor for the flow meter. Each of the 3 individual values of Yi must be within ± 0.02 of Y. (C) Except as otherwise provided in	

	subparagraphs (vi) or (vii) of this subdivision, use the average Y value from the 3-level calibration to adjust all subsequent gas volume measurements made with the gas flow meter. (vi) Initial on-site calibration check. For a mass flow meter that was initially calibrated using a compressed gas mixture, an on-site calibration check shall be performed before using the flow meter to provide data for this part. The following apply: (A) While sampling stack gas, check the calibration of the flow meter at 1 intermediate flow rate typical of normal operation of the monitoring system. Follow the basic procedures in paragraph (ii) or (iii) of this subdivision. (B) If the on-site calibration check shows that the value of Yi, the calibration factor at the tested flow rate, differs by more than 5% from the value of Y obtained in the initial calibration of the meter, repeat the full 3-level calibration of the meter using stack gas to determine a new value of Y, and apply the new Y value to all subsequent gas volume measurements made with the gas flow meter. (vii) Ongoing quality assurance. Recalibrate the gas flow meter quarterly at 1 intermediate flow rate setting representative of normal operation of the monitoring system. The following apply: (A) Follow paragraph (ii) or (iii) of this subdivision, as appropriate. (B) If a quarterly recalibration shows that the value of Yi, the calibration factor at the tested flow rate, differs from the current value of Y by more than 5%, repeat the	

	full 3-level calibration of the meter to determine a new value of Y, and apply the new Y value to all subsequent gas volume measurements made with the gas flow meter. (b) Thermocouples and other temperature sensors. Use the procedures and criteria in section 10.3 of method 2 in appendix A–1 to 40 C.F.R. part 60. The following apply: (i) Dial thermometers shall be calibrated against mercury-in-glass thermometers. (ii) Calibrations shall be performed prior to initial use and at least quarterly thereafter. (iii) At each calibration point, the absolute temperature measured by the temperature sensor shall agree to within ± 1.5% of the temperature measured with the reference sensor, otherwise the sensor may not continue to be used. (c) Barometer. Calibrate against a mercury barometer. Calibration shall be performed prior to initial use and at least quarterly thereafter. At each calibration point, the absolute pressure measured by the barometer shall agree to within ± 10 millimeters of mercury of the pressure measured by the mercury barometer, otherwise the barometer may not continue to be used. (d) Other sensors and gauges. Calibrate all other sensors and gauges according to the procedures specified by the instrument manufacturer or manufacturers. (7) Analytical procedures. The analysis of the mercury samples may be conducted using any instrument or technology capable of quantifying total mercury from the	

	sorbent media and meeting the performance criteria in subrule (5) of this rule. (a) Analyzer system calibration. Perform a multipoint calibration of the analyzer at 3 or more upscale points over the desired quantitative range, multiple calibration ranges shall be calibrated, if necessary. The field samples analyzed shall fall within a calibrated, quantitative range and meet the necessary performance criteria. The following apply: (i) For samples that are suitable for aliquotting, a series of dilutions may be needed to ensure that the samples fall within a calibrated range. However, for sorbent media samples that are consumed during analysis, for example, thermal desorption techniques, extra care must be taken to ensure that the analytical system is appropriately calibrated prior to sample analysis. The calibration curve range or ranges should be determined based on the anticipated level of mercury mass on the sorbent media. Knowledge of estimated stack mercury concentrations and total sample volume may be required prior to analysis. (ii) The calibration curve for use with the various analytical techniques, for example, UV AA, UV AF, and XRF, can be generated by directly introducing standard solutions into the analyzer or by spiking the standards onto the sorbent media and then introducing into the analyzer after preparing the sorbent/standard according to the particular analytical technique. (iii) For each calibration curve, the value of the square of the linear	

	correlation coefficient, for example, r2 , shall be ≥ 0.99, and the analyzer response shall be within ± 10% of reference value at each upscale calibration point. Calibrations shall be performed on the day of the analysis, before analyzing any of the samples. (iv) Following calibration, an independently prepared standard from a separate calibration stock solution shall be analyzed. The measured value of the independently prepared standard shall be within ± 10% of the expected value. (b) Sample preparation. Carefully separate the 3 sections of each sorbent trap. The following apply: (i) Combine for analysis all materials associated with each section. (ii) Any supporting substrate that the sample gas passes through prior to entering a media section including but not limited to glass wool, polyurethane foam, or other substrates shall be analyzed with that segment. (c) Spike recovery study. Before analyzing any field samples, the laboratory shall demonstrate the ability to recover and quantify mercury from the sorbent media by performing the following spike recovery study for sorbent media traps spiked with elemental mercury . The following apply: (i) Using the procedures described in subrules (2)(b) and (8)(b) of this rule, spike the third section of 9 sorbent traps with gaseous Hg0, for example, 3 traps at each of 3 different mass loadings, representing the range of masses anticipated in the field samples. This will yield a 3 × 3 sample	

	matrix. (ii) Prepare and analyze the third section of each spiked trap, using the techniques that will be used to prepare and analyze the field samples. The average recovery for each spike concentration shall be between 85% and 115%. (iii) If multiple types of sorbent media are to be analyzed, a separate spike recovery study is required for each sorbent material. (iv) If multiple ranges are calibrated, a separate spike recovery study is required for each range. (d) Field sample analysis. Analyze the sorbent trap samples following the same procedures that were used for conducting the spike recovery study. The 3 sections of each sorbent trap shall be analyzed separately. The following apply: (i) Quantify the total mass of mercury for each section based on analytical system response and the calibration curve. (ii) Determine the spike recovery from sorbent trap section 3. The spike recovery shall be no less than 75% and no greater than 125%. (iii) To report the final mercury mass for each trap, add together the mercury masses collected in trap sections 1 and 2. (8) The following calculations and data analysis apply: (a) Calculation of pre-sampling spiking level. Determine sorbent trap section 3 spiking level using estimates of the stack mercury concentration, the target sample flow rate, and the expected sample duration. First, calculate the expected mercury mass that will be collected in section 1 of the trap. The pre-sampling spike shall be	

	within ± 50% of this mass. (b) Example calculation for an estimated stack mercury concentration of 5 micrograms per cubic meter (μg/m3), a target sample rate of 0.30 liter per minute (L/min), and a sample duration of 5 days: (0.30 L/min)*(1440 minutes per day)*(5 days)*(10−3 cubic meter per liter)*(5 μg/m3) = 10.8 micrograms (μg). Therefore, a pre-sampling spike of 10.8 μg ± 50% is appropriate. (c) Calculations for flow-proportional sampling. The following apply: (i) For the first hour of the data collection period, determine the reference ratio of the stack gas volumetric flow rate to the sample flow rate, as follows: [See attached equation] (ii) Then, for each subsequent hour of the data collection period, calculate ratio of the stack gas flow rate to the sample flow rate using the following equation: [See attached equation] (d) Calculation of spike recovery. Calculate the percent recovery of each section 3 spike, using the following equation: [See attached equation] (e) Calculation of breakthrough. Calculate the percent breakthrough to the second section of the sorbent trap, using the following equation: [See attached equation]	

	<u>(f) Calculation of mercury concentration. Calculate the mercury concentration for each sorbent trap, using the following equation:</u> [See attached equation] <u>(g) Calculation of paired trap agreement. Calculate the relative deviation between the mercury concentrations measured with the paired sorbent traps using the following equation:</u> [See attached equation] <u>(h) Use the average of the 2 mercury concentrations from the paired traps in the calculations, except as provided in table 111.</u> History: 2009 AACS.	
R 336.2159 Alternative continuous emission monitoring systems. **Rule 1159**. The department may provide approval for alternative monitoring systems that do not comply with the requirements of this part, if the owner or operator demonstrates both of the following: (a) That an equivalent alternative emission monitoring system shall be implemented that satisfies the intent of the requirements of this part. (b) That 1 of the following conditions exists: (i) A continuous emission monitoring system that conforms with the requirements of this part will not provide an accurate determination of emissions. (ii) The affected source is operated less than 1 month per year. (iii) A continuous emission monitoring system that conforms	**R 336.2159 Alternative continuous emission monitoring systems.** **Rule 1159**. The department may provide approval for alternative monitoring systems that do not comply with the requirements of this part, if the owner or operator demonstrates both of the following: (a) That an equivalent alternative emission monitoring system shall be implemented that satisfies the intent of the requirements of this part. (b) That 1 of the following conditions exists: (i) A continuous emission monitoring system that conforms with the requirements of this part will not provide an accurate determination of emissions. (ii) The affected source is operated less than 1 month per year. (iii) A continuous emission monitoring system that conforms	**Rule 1159**. Same.

with the requirements of this part cannot be installed due to physical limitations of the source.	with the requirements of this part cannot be installed due to physical limitations of the source. History: 1980 AACS; 2002 AACS.	
	R 336.2160 Mercury low mass emitter monitoring methodology. **Rule 1160**. (1) The owner or operator of an affected unit that emits less than 464 ounces (29 pounds) of mercury per year may use the mercury low mass emitter monitoring methodology after performing initial certification testing. The owner or operator of the affected unit shall perform the initial certification testing and ongoing quality assurance as described in subrules (2) and (3) of this rule. The initial test shall be performed within 60 days of the effective date of these rules or 90 days prior to the compliance date, whichever is later. (2) For the initial certification testing, the following shall apply: (a) The owner or operator shall perform mercury emission testing to determine the mercury concentration, for example, total vapor-phase mercury, in the effluent. (b) Testing shall be performed using 1 of the following mercury reference methods: Method 29, ASTM D6784-02, method 30A, or method 30B. A test shall consist of a minimum of 3 runs at maximum routine load while firing fuel or fuels with the highest mercury content. (c) The minimum run time shall be 1 hour if method 30A is used. If method 29, ASTM D6784-02, or method 30B is used, paired samples are required for each test run and the runs shall be long enough to ensure	**Rule 1160**. This rule does not have a federal equivalent.

	that sufficient mercury is collected to analyze. When method 29, or ASTM D6784 02 is used the test results shall be based on the vapor-phase mercury collected in the back half of the sampling train. For each method 29, ASTM D6784-02, or method 30B test run, the paired trains shall meet the relative deviation requirement specified in method 30B. If the relative deviation specification is met, the result of the 2 samples shall be averaged arithmetically. (d) If the unit is equipped with flue gas desulfurization or add-on mercury emission controls, the controls shall be operating normally during the testing, and for the purpose of establishing proper operation of the controls, parametric data shall be recorded. (e) A complete test plan and test notification shall be provided to the department 30 days prior to the testing. (3) Based on the results of emission testing, the following equation shall be used to provide a conservative estimate of the annual mercury mass emissions for the unit: E = N K CHg Qmass Where: E = Estimated annual mercury mass emissions in ounces per year. N = 8760 hours or the maximum number of operating hours per year allowed by the unit's federally enforceable permit. K = 9.978 x 10-10 ounces-scm/?g-standard cubic foot (scf). CHg = Highest mercury concentration (?g/scm) from any test run or 0.05 ?g/scm, whichever is greater.	

	Qmass = Maximum potential flow rate. (a) If the estimated annual mercury mass emissions are 464 ounces per year or less, the unit is eligible to use the monitoring methodology of this section, and mercury continuous emission monitoring is not required. (b) The results of the testing performed under this rule shall be submitted as a certification application to the department, not later than 45 days after the test is completed. The calculations demonstrating that the unit emits less than 464 ounces per year shall be provided, and the default mercury concentration that will be used for mercury mass emission reporting shall be specified. (c) Following initial certification: (i) The default mercury concentration used to estimate the unit's annual mercury mass emissions shall be reported for each unit operating hour and shall be used to calculate hourly mercury emissions. (ii) The mercury emission testing described in this rule shall be repeated periodically for the purpose of quality assurance, as follows: (A) If the results of the certification testing under this rule show that the unit emits 144 ounces (9 pounds) per year or less, the first retest is required by the end of the fourth quarter following the calendar quarter of the certification test. (B) If the results of the certification test under this section shows that the unit emits more than 144 ounces per year but less than 464 ounces per year, the first retest is required by the end of the second quarter following the calendar quarter of the	

	certification test. (C) Retesting shall be required either by the end of the second or fourth quarter following the quarter of the previous test, depending on the results of the previous test. To determine whether the next retest is required within 2 or 4 quarters, substitute the highest mercury concentration from the current test or 0.50 µg/scm, whichever is greater, into the equation under subrule (3). If the estimated annual mass emissions exceed 144 ounces, the next test is due within 2 quarters. If the estimated annual mass emissions are 144 ounces or less, the next test is due within 4 quarters. (d) The updated mercury default concentration shall be applied beginning with the first unit operating hour after the completion of the retest. (e) If the unit is equipped with flue gas desulfurization system or add-on mercury controls, the owner or operator shall record the parametric data for each unit operating hour. (f) An additional retest is required when there is a change in coal rank of the primary fuel or other significant fuel change. (g) At the end of each calendar year, if the cumulative annual mercury mass emission from an affected unit exceeds 464 ounces, the owner or operator shall install, certify, operate, and maintain a mercury continuous emission monitoring system, or sorbent trap monitoring system, not later than 180 days after the end of the calendar year in which the emissions exceeded 464 ounces. History: 2009 AACS.	

	R 336.2161 Specifications and test procedures for total vapor-phase mercury continuous emission monitoring systems; definitions; scope; application; methodology. **Rule 1161**. (1) Definitions as used in this rule: (a) “Calibration drift” means the absolute value of the difference between the continuous emission monitoring system (CEMS) output response and either the upscale mercury reference gas or the zero-level mercury reference gas, expressed as a percentage of the span value, when the entire CEMS, including the sampling interface, is challenged after a stated period of operation during which no unscheduled maintenance, repair, or adjustment took place. (b) “Continuous emission monitoring system” (CEMS) means the total equipment required for the determination of a pollutant concentration. The system consists of the major subsystems defined in subrule (1)(a) and (c) to (h) of this rule. (c) “Data recorder” means that portion of the CEMS that provides a permanent electronic record of the analyzer output. The data recorder may provide automatic data reduction and CEMS control capabilities. (d) “Linearity” means the absolute value of the difference between the concentration indicated by the mercury analyzer and the known concentration of a reference gas, expressed as a percentage of the span value, when the entire CEMS, including the sampling interface, is challenged. A linearity test procedure is performed to document	**Rule 1161**. There is not a federal equivalent to this rule.

	the linearity of the mercury CEMS at 3 or more points over the measurement range. (e) “Mercury analyzer” means that portion of the mercury CEMS that measures the total vapor-phase mercury mass concentration and generates a proportional output. (f) “Relative accuracy” means the absolute mean difference between the pollutant concentration(s) determined by the CEMS and the value determined by the reference method plus the 2.5% error confidence coefficient of a series of tests divided by the mean of the reference method tests. Alternatively, for sources with an average reference method concentration less than 5.0 μg/dscm, the relative accuracy may be expressed as the absolute value of the difference between the mean CEMS and reference method values. (g) “Sample interface” means that portion of the CEMS used for 1 or more of the following: sample acquisition, sample transport, sample conditioning, and protection of the monitor from the effects of the stack effluent. (h) “Span value” means the upper limit of the intended mercury concentration measurement range. The span value is a value equal to 2 times the emission standard. (2) This rule specifies sampling, analytical, and quality-assurance criteria and procedures for continuous emission monitoring of total vapor-phase mercury emissions in combustion flue gas streams, using a CEMS. (a) Analyte. The analyte measured by these procedures and specifications is total vapor-phase	

	mercury in the flue gas, which represents the sum of elemental mercury (Hg0, CAS Number 7439–97–6) and oxidized forms of gaseous mercury (Hg+2), in mass concentration units of µg/dscm. (b) Applicability. The performance criteria and procedures are applicable to evaluating the acceptability of total vapor-phase mercury CEMSs installed at stationary sources at the time of or soon after installation and whenever specified in the regulations. (i) The mercury CEMS must be capable of measuring the total mass concentration in µg/dscm (regardless of speciation) of total vapor-phase mercury, and recording that concentration on a wet or dry basis. Particle bound mercury is not included in the measurements. (ii) This applicability specification is not designed to evaluate an installed CEMS's performance over an extended period of time nor does it identify specific calibration techniques and auxiliary procedures to assess the CEMS's performance. (A) The source owner or operator is responsible to calibrate, maintain, and operate the CEMS properly. The department may require the operator to conduct CEMS performance evaluations at other times besides the initial test to evaluate the CEMS performance. (3) Equipment and supplies. The CEMS equipment specifications are as follows: (a) Data recorder scale. The mercury CEMS data recorder output range must include zero and a high level value. (i) The high level value must be approximately 2 times the mercury	

	concentration corresponding to the emission standard level for the stack gas under the circumstances existing as the stack gas is sampled. A lower high level value may be used, provided that the measured values do not exceed 95% of the high level value. (ii) The CEMS design should also provide for the determination of continuous emissions at a zero value (zero to 20% of the span value) and at an upscale value (between 50 and 100% of the high-level value). (b) Reference gas delivery system. The reference gas delivery system must be designed so that the flowrate of reference gas introduced to the CEMS is the same at all 3 challenge levels specified in subrule (4) of this rule, and at all times exceeds the flow requirements of the CEMS. (c) Other equipment and supplies, as needed by the applicable reference method used are specified in subrule (5) of this rule. (4) Reference gases reagents and standards. Reference gas standards are required for both Hg0 (elemental) and oxidized mercury (mercury and mercuric chloride, HgCl2). Only NIST-certified or NIST-traceable calibration gas standards and reagents shall be used for the tests and procedures required in this rule. (a) The gas concentrations required are as follows: (i) Zero-level. 0 to 20% of the span value. (ii) Mid-level. 50 to 60% of the span value. (iii) High-level. 80 to 100% of the span value. (b) Reference gas standards may	

	also be required for the reference methods as specified in subrule (5) of this rule. (5) Performance specification test procedures. (a) Installation and measurement location specifications. Install the CEMS at an accessible location downstream of all pollution control equipment. (i) Since the mercury CEMS sample system normally extracts gas from a single point in the stack, use a location that has been shown to be free of stratification for mercury or alternatively, sulfur dioxide and oxides of nitrogen through concentration measurement traverses for those gases. (ii) If the cause of failure to meet the relative accuracy test requirement is determined to be the measurement location and a satisfactory correction technique cannot be established, the department may require the CEMS to be relocated. Measurement locations and points or paths that are most likely to provide data that will meet the relative accuracy requirements are as follows: (A) The measurement location should be (1) at least 2 equivalent diameters downstream of the nearest control device, point of pollutant generation or other point at which a change of pollutant concentration may occur, and (2) at least half an equivalent diameter upstream from the effluent exhaust. The equivalent duct diameter is calculated as per 40 CFR part 60, appendix A, method 1, as adopted by reference in R 336.2150. (B) Use a sample extraction point either (1) no less than 1.0	

	meter from the stack or duct wall, or (2) within the centroidal velocity traverse area of the stack or duct cross section. (b) Reference method measurement location and traverse points. Refer to performance specification 2 adopted by reference in R 336.2150. The reference method and CEMS locations need not be immediately adjacent. (c) Linearity test procedure. The mercury CEMS must be constructed to permit the introduction of known concentrations of mercury and HgCl2 separately into the sampling system immediately preceding the sample extraction filtration system such that the entire CEMS can be challenged. (i) Sequentially inject each of at least 3 reference gases (zero, mid-level, and high level) for each mercury species. (ii) Record the CEMS response and subtract the reference value from the CEMS value, and express the absolute value of the difference as a percentage of the span value (see example data sheet in table 112). (A) For each reference gas, the absolute value of the difference between the CEMS response and the reference value shall not exceed 5% of the span value. If this specification is not met, identify and correct the problem before proceeding. Table 112 Linearity and Continuous Emission Determination Form [See attached table] (d) Seven-day calibration drift test procedure. While the affected	

	facility is operating at more than 50% of normal load, or as specified in an applicable regulation, determine the magnitude of the calibration drift once each day (at 24-hour intervals, to the extent practicable) for 7 consecutive unit operating days according to the procedure given in this subrule. The 7 consecutive unit operating days need not be 7 consecutive calendar days. Use either Hg_0 or $HgCl_2$ standards for this test. (i) The purpose of the calibration drift measurement is to verify the ability of the CEMS to conform to the established CEMS response used for determining emission concentrations or emission rates. Therefore, if periodic automatic or manual adjustments are made to the CEMS zero and upscale response settings, conduct the calibration drift test immediately before these adjustments, or conduct it in such a way that the calibration drift can be determined. (ii) Conduct the calibration drift test using the zero gas specified and either the mid-level or high-level point specified in subrule (4) of this rule. (A) Introduce the reference gas to the CEMS. (B) Record the CEMS response and subtract the reference value from the CEMS value, and express the absolute value of the difference as a percentage of the span value (see example data sheet in table 112). (C) For the reference gas, the absolute value of the difference between the CEMS response and the reference value shall not exceed 5% of the span value. If this	

	specification is not met, identify and correct the problem before proceeding. (e) Relative accuracy test procedure. Conduct the relative accuracy test according to the procedure given in subrule (5)(e) to (f) of this rule, while the affected facility is operating at normal full load, or as specified in an applicable subpart. The relative accuracy test may be conducted during the calibration drift test period. (i) Reference method for mercury concentration. Unless otherwise specified in an applicable subpart of the regulations, use method 29, method 30A, or method 30B as adopted by reference in R 336.2004 or ASTM method D6784–02, adopted by reference in R 336.2502, as the reference method for mercury concentration. The filterable portion of the sample need not be included when making comparisons to the CEMS results. (A) When method 29, method 30B, or ASTM D6784–02 is used, conduct the reference method test runs with paired or duplicate sampling systems. (B) When method 30A is used, paired sampling systems are not required. (C) If the reference method and CEMS measure on a different moisture basis, data derived with method 4, adopted by reference in R 336.2004, must be obtained during the relative accuracy test. (ii) Sampling strategy for reference method tests. Conduct the reference method tests in such a way that they will yield results representative of the emissions from the source and can be compared to the CEMS data.	

	(A) It is preferable to conduct moisture measurements (if needed) and mercury measurements simultaneously, although moisture measurements that are taken within an hour of the mercury measurements may be used to adjust the mercury concentrations to a consistent moisture basis. (B) In order to correlate the CEMS and reference method data properly, note the beginning and end of each reference method test period for each paired reference method run (including the exact time of day) on the CEMS chart recordings or other permanent record of output. (iii) Number and length of reference method and tests. Conduct a minimum of 9 reference method test runs. (A) When method 29, method 30B, or ASTM D6784–02 is used, only test runs for which the paired reference method trains meet the relative deviation criteria of this performance specification shall be used in the relative accuracy calculations. In addition, for method 29 and ASTM D6784–02, use a minimum sample time of 2 hours and for method 30A use a minimum sample time of 30 minutes. (B) More than 9 sets of reference method tests may be performed. If this option is chosen, paired reference method test results may be excluded so long as the total number of paired reference method test results used to determine the CEMS relative accuracy is greater than or equal to 9. However, all data must be reported including the excluded data. (iv) Correlation of reference method and CEMS data. Correlate the	

	CEMS and the reference method test data as to the time and duration by first determining from the CEMS final output (the one used for reporting) the integrated average pollutant concentration for each reference method test period. (A) Consider system response time, if important, and confirm that the results are on a consistent moisture basis with the reference method test. Then, compare each integrated CEMS value against the corresponding reference method value. (B) When method 29, method 30A, method 30B, or ASTM D6784–02 is used, compare each CEMS value against the corresponding average of the paired reference method values. (v) Paired reference method outliers. When method 29, method 30B, or ASTM D6784–02 is used, outliers are identified through the determination of relative deviation of the paired reference method tests. Data that do not meet the criteria should be flagged as a data quality problem. (A) The primary reason for performing paired reference method sampling is to ensure the quality of the reference method data. The percent relative deviation of paired data is the parameter used to quantify data quality. Determine relative deviation for 2 paired data points as follows: [See attached equation] Where: RD = Relative deviation of paired reference methods tests, a and b. Ca = Concentration of total vapor-phase mercury, for sample a,	

	(µg/dscm). Cb = Concentration of total vapor-phase mercury, for sample b, (µg/dscm). (B) A minimum performance criteria for reference method mercury data is that relative deviation for any data pair must be ≤ 10% as long as the mean mercury concentration is greater than 1.0 µg/m3. (C) If the mean mercury concentration is less than or equal to 1.0 µg/m3, the relative deviation must be ≤ 20%. (D) Pairs of reference method data exceeding these relative deviation criteria should be eliminated from the data set used to develop a mercury CEMS correlation or to assess CEMS relative accuracy. (vi) Calculate the mean difference between the reference method and CEMS values in the units of µg/m3, the standard deviation, the confidence coefficient, and the relative accuracy according to the procedures in subrule (7) of this rule. (f) Reporting. At a minimum, summarize in tabular form the results of the relative deviation tests and the relative accuracy tests or alternative relative accuracy procedure, as appropriate. Include all data sheets, calculations, charts (records of CEMS responses), reference gas concentration certifications, and any other information necessary to confirm that the performance of the CEMS meets the performance criteria. (6) Analytical procedure. Sample collection and analysis are concurrent (see subrule (5) of this rule). Refer to the reference method	

	employed for specific analytical procedures. (7) Calculations and data analysis. Summarize the results on a data sheet similar to performance standard 2 (figure 2-2), as adopted by reference in R 336.2150. (a) Consistent basis. All data from the reference method and CEMS must be compared in units of μg/m3, on a consistent and identified moisture basis. Standard temperature and pressure are defined as 20 degrees Celsius and 760 millimeters of mercury, respectively (i) Moisture correction (as applicable). If the reference method and CEMS measure mercury on a different moisture basis, use the following equation to make the appropriate corrections to the mercury concentrations: [See attached equation] Where: Concentration(*dry*) = Concentration of total vapor-phase mercury on a dry basis, regardless of speciation, (μg/dscm). Concentration(wet) = Concentration of total vapor-phase mercury on a wet basis, regardless of speciation, (μg/dscm). Bws = Moisture content of the flue gas from method 4, expressed as a decimal fraction (e.g., for 8.0% water or H2O, Bws = 0.08). (b) Arithmetic Mean. Calculate the arithmetic mean of the difference of a dataset as follows:	
	[See attached equation] Where:	

d = Arithmetic mean of the difference of a dataset.
n = Number of data points.
[See attached figure]= Algebraic sum of the individual differences of data points.
(c) Standard Deviation. Calculate the standard deviation as follows:

[See attached equation]

Where:
Sd = Standard deviation of the data sets.
[See attached figure] = Algebraic sum of the individual differences of data points squared.
[See attached figure] = Algebraic sum of the individual differences of data points.
n = Number of data points.
(d) Confidence coefficient. Calculate the 2.5% error confidence coefficient (1-tailed)
as follows:

[See attached equation]

CC = Confidence coefficient of percent error.
t0.975 = Values given in table 113.
Sd = Standard deviation of the data sets.
√n = Square root of the number of data points.
Table 113

[See attached table]

a Values already corrected for n-1 degrees of freedom.
n = Number of individual values.
(e) Relative accuracy. Calculate the relative accuracy of a set of data as follows:

	[See attached equation] Where: RA = Relative accuracy. *d* = Absolute mean value of the data point differences (from subrule (7)(b)). |CC| = Absolute value of the confidence coefficient (from subrule (7)(d)). *RM* = Average reference method value. (8) Method performance. (a) Linearity. Linearity is assessed at zero-level, mid-level and high-level values as given in table 113 using standards for both Hg0 and HgCl2. The mean difference between the indicated CEMS concentration and the reference concentration value for each standard shall be no greater than 5% of the span value. (b) Calibration drift. The calibration drift shall not exceed 5% of the span value on any of the 7 days of the calibration drift test. (c) Relative accuracy. The relative accuracy of the CEMS must be no greater than 10% of the mean value of the reference method test data in terms of units of µg/dscm. Alternatively: (i) If the mean reference method is less than 10.0 µg/dscm, then the relative accuracy of the CEMS must be no greater than 20%, or (ii) If the mean reference method is less than 5.0 µg/m3, the results are acceptable if the absolute value of the difference between the mean reference method and CEMS values does not exceed 1.0 µg/dscm. History: 2009 AACS.	
R 336.2170 Monitoring data reporting and recordkeeping.	**R 336.2170 Monitoring data reporting and recordkeeping.**	

Rule 1170. (1) The owner or operator of any continuous emission monitoring system required by this part shall submit to the department, within 30 days of the end of a calendar quarter, a written report for each calendar quarter which shall include all of the following information: (a) Excess emissions and the nature and cause of the excess emissions, if known, as follows: (i) For opacity measurements, the report shall consist of the magnitude, in actual percent opacity, of all 6-minute averages of opacity more than the applicable opacity standard for each hour of operation (all allowable exceptions are to be deducted before determining the excess averages of opacity). Average values shall be obtained by integration over the averaging period or by arithmetically averaging a minimum of 24 equally spaced, instantaneous opacity measurements per 6 minutes. (ii) For gaseous measurements, the report shall consist of emission averages, in the units of the applicable standard, for each averaging period during which the applicable standard was exceeded. (b) The date and time identifying each period during which the continuous monitoring system was inoperative, except for zero and span checks, and the nature of repairs or adjustments made. (c) If the continuous monitoring system has not been inoperative, repaired, or adjusted, and if no excess emissions occurred, a statement attesting to this fact. (2) The owner or operator of any	**Rule 1170**. (1) The owner or operator of any continuous emission monitoring system required by this part shall submit to the department, within 30 days of the end of a calendar quarter, a written report for each calendar quarter which shall include all of the following information: (a) Excess emissions and the nature and cause of the excess emissions, if known, as follows: (i) For opacity measurements, the report shall consist of the magnitude, in actual percent opacity, of all 6-minute averages of opacity more than the applicable opacity standard for each hour of operation (all allowable exceptions are to be deducted before determining the excess averages of opacity). Average values shall be obtained by integration over the averaging period or by arithmetically averaging a minimum of 24 equally spaced, instantaneous opacity measurements per 6 minutes. (ii) For gaseous measurements, the report shall consist of emission averages, in the units of the applicable standard, for each averaging period during which the applicable standard was exceeded. (b) The date and time identifying each period during which the continuous monitoring system was inoperative, except for zero and span checks, and the nature of repairs or adjustments made. (c) If the continuous monitoring system has not been inoperative, repaired, or adjusted, and if no excess emissions occurred, a statement attesting to this fact. (2) The owner or operator of any	**Rule 1170**. This rule is the same in the state and federal versions.

continuous emission monitoring system required by this part shall maintain a file of all information reported in the quarterly reports and all other data collected, either by the continuous monitoring system or as necessary to convert monitoring data to the units of the applicable standard, for a minimum of 2 years from the date of collection of the data or submission of the reports.	continuous emission monitoring system required by this part shall maintain a file of all information reported in the quarterly reports and all other data collected, either by the continuous monitoring system or as necessary to convert monitoring data to the units of the applicable standard, for a minimum of 2 years from the date of collection of the data or submission of the reports. History: 1980 AACS; 2002 AACS.	
R 336.2175 Data reduction procedures for fossil fuel-fired steam generators. **Rule 1175**. (1) The owner or operator of a fossil fuel-fired steam generator that is subject to the provisions of this part shall convert gaseous emission monitoring data in parts per million to pounds per million Btu’s using either of the following procedures: (a) When the owner or operator elects to measure oxygen in the flue gases, the measurements of the pollutant concentration and oxygen concentration shall each be on a consistent basis (wet or dry). When measurements are on a dry basis, the following conversion procedure shall be used: [See attached equation] When measurements are on a wet basis, alternative procedures approved by the department shall be used. (b) When the owner or operator elects to measure carbon dioxide in the flue gases, the measurements of the pollutant concentration and carbon dioxide concentration shall each be on a consistent basis (wet or	**R 336.2175 Data reduction procedures for fossil fuel-fired steam generators.** **Rule 1175**. (1) The owner or operator of a fossil fuel-fired steam generator that is subject to the provisions of this part shall convert gaseous emission monitoring data in parts per million to pounds per million Btu's using either of the following procedures: (a) When the owner or operator elects to measure oxygen in the flue gases, the measurements of the pollutant concentration and oxygen concentration shall each be on a consistent basis (wet or dry). When measurements are on a dry basis, the following conversion procedure shall be used: [See attached equation] When measurements are on a wet basis, alternative procedures approved by the department shall be used. (b) When the owner or operator elects to measure carbon dioxide in the flue gases, the measurements of the pollutant concentration and carbon dioxide concentration shall each be on a consistent basis (wet or	**Rule 1175**. Same, except as noted below.

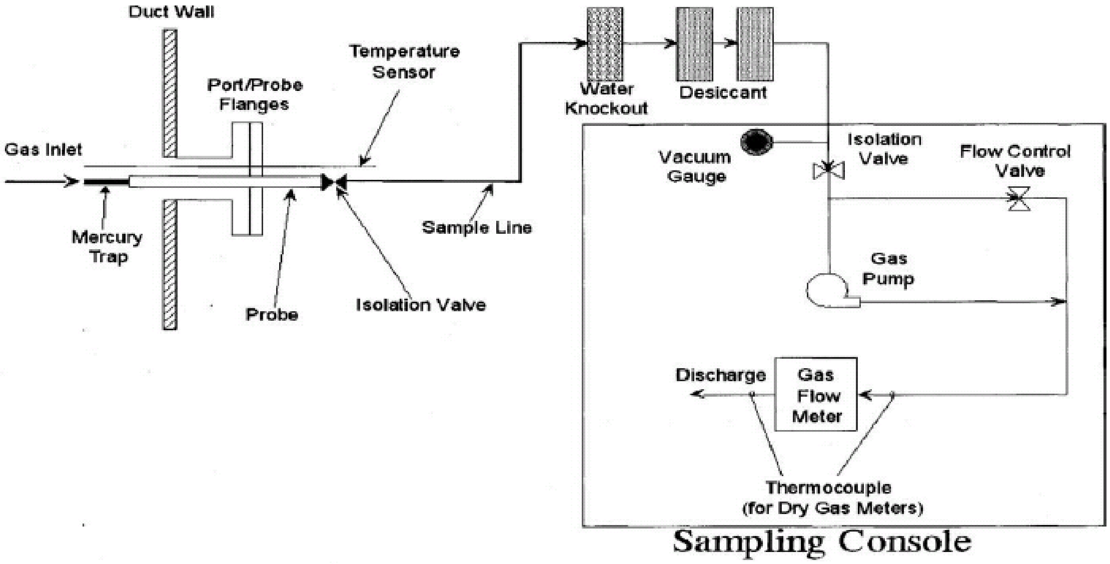
dry) and the following conversion procedure shall be used: [See attached equation] (2) The values used in the equations in subrule (1) of this rule shall be derived as follows: (a) “E” is the pollutant emission in pounds per million Btu’s. (b) “C” is the pollutant concentration in pounds per dry standard cubic foot determined by multiplying the average concentration, in parts per per million, for each hourly period by 2.59 X 10^{-9} M pounds per dry standard cubic foot per part per million where M is the pollutant molecular weight in pounds per pound mole (M equals 64.07 for sulfur dioxide and 46.01 for oxides of nitrogen). (c) “% O_2” or “% CO_2” is the oxygen or carbon dioxide volume, expressed as percent, determined with equipment required by R 336.2101. (d) “F” or “F_c” is a factor representing a ratio of the volume of dry flue gases generated to the calorific value of the fuel combusted (F) or a factor representing a ratio of the volume of carbon dioxide generated to the calorific value of the fuel combusted (F_c). Values of F and F_c are listed in the standards of performance for new stationary sources, 40 C.F.R.-§60.45(f) (2000).	dry) and the following conversion procedure shall be used: [See attached equation] (2) The values used in the equations in subrule (1) of this rule shall be derived as follows: (a) "E" is the pollutant emission in pounds per million Btu's. (b) "C" is the pollutant concentration in pounds per dry standard cubic foot determined by multiplying the average concentration, in parts per million, for each hourly period by 2.59 X 10-9 M pounds per dry standard cubic foot per part per million where M is the pollutant molecular weight in pounds per pound mole (M equals 64.07 for sulfur dioxide and 46.01 for oxides of nitrogen). (c) "% 0^2" or "% $C0^2$" is the oxygen or carbon dioxide volume, expressed as percent, determined with equipment required by R 336.2101. (d) "F" or "Fc" is a factor representing a ratio of the volume of dry flue gases generated to the calorific value of the fuel combusted (F) or a factor representing a ratio of the volume of carbon dioxide generated to the calorific value of the fuel combusted (Fc). Values of F and Fc are listed in the standards of performance for new stationary sources, 40 C.F.R.§60.45(f) (2000). History: 1980 AACS; 1989 AACS; 2002 AACS.	No space in the state SIP.
R 336.2176 Data reduction procedures for sulfuric acid plants. ~~**(1/18/80)**~~ **Rule 1176**. The owner or operator of	**R 336.2176 Data reduction procedures for sulfuric acid plants.** **Rule 1176**. The owner or operator	No date in the state SIP. **Rule 1176**. Same, except as

a sulfuric acid plant subject to the provisions of this part shall do both of the following: (a) Establish a conversion factor 3 times daily according to the procedures in standards of performance for new stationary sources, 40 C.F.R. ~~§~~60.84(b) (July 1, ~~1978~~). (b) Multiply the conversion factor by the average sulfur dioxide concentration in the flue gases to obtain the average sulfur dioxide emissions in pounds per short ton.	of a sulfuric acid plant that is subject to the provisions of this part shall do both of the following: (a) Establish a conversion factor 3 times daily according to the procedures in the standards of performance for new stationary sources, 40 C.F.R. S60.84(b) (July 1, 1982). (b) Multiply the conversion factor by the average sulfur dioxide concentration in the flue gases to obtain the average sulfur dioxide emissions in pounds per short ton. History: 1980 AACS; 1989 AACS.	otherwise noted. Editorial changes. Editorial changes. "S" rather than "§" in state SIP. Updated date.
R 336.2189 Alternative data reporting or reduction procedures. **Rule 1189**. The department may provide approval for alternative data reporting or reduction procedures that do not comply with the requirements of this part if the owner or operator demonstrates, to the satisfaction of the department, that the procedures are at least as accurate as the procedures identified in this part.	**R 336.2189 Alternative data reporting or reduction procedures.** **Rule 1189**. The department may provide approval for alternative data reporting or reduction procedures that do not comply with the requirements of this part if the owner or operator demonstrates, to the satisfaction of the department, that the procedures are at least as accurate as the procedures identified in this part. History: 1980 AACS; 2002 AACS.	**Rule 1189**. Federal and state SIP are the same.
R 336.2190 Monitoring system malfunctions. **Rule 1190**. The monitoring and reporting requirements of this part shall not apply during any period of monitoring system malfunction if the source owner or operator demonstrates both of the following to the satisfaction of the department: (a) That the cause of the malfunction could not have been avoided by any course of action that could have reasonably been expected of the owner or operator. (b) That the necessary repairs are	**R 336.2190 Monitoring system malfunctions.** **Rule 1190**. The monitoring and reporting requirements of this part shall not apply during any period of monitoring system malfunction if the source owner or operator demonstrates both of the following to the satisfaction of the department: (a) That the cause of the malfunction could not have been avoided by any course of action that could have reasonably been expected of the owner or operator. (b) That the necessary repairs are	**Rule 1190**. Federal and state SIP are the same.

being made as expeditiously as practicable.	being made as expeditiously as practicable. History: 1980 AACS; 2002 AACS.	
R 336.2199. Exemptions from continuous emission monitoring requirements. ~~(1/18/80)~~ **Rule 1199**. The requirements of ~~rules 1101, 1102, and 1103~~ do not apply to any of the following: (a) A source subject to a new source performance standard promulgated in standards of performance for new stationary sources, ~~40~~ C.F.R. part 60 (July 1, ~~1978~~), pursuant to section 111 of the clean air act, as amended, 42 U.S.C. ~~§7413~~. (b) A source not subject to an applicable emission standard.	**R 336.2199 Exemptions from continuous emission monitoring requirements.** **Rule 1199**. The requirements of R 336.2101, R 336.2102, and R 336.2103 do not apply to either of the following: (a) A source subject to a new source performance standard promulgated in the standards of performance for new stationary sources, 30 C.F.R. part 60 (July 1, 1982), pursuant to section 111 of the clean air act of 1963, as amended, 42 U.S.C. 7411. (b) A source is not subject to an applicable emission standard. History: 1980 AACS; 1989 AACS; 1997 AACS.	No date in state SIP. **Rule 1199**. Same, except as noted. Rules cited differently. Different federal regulations cited in state and federal SIP. Date updated. Date added to Clean Air Act. Unconstitutional section cited in federal SIP; different section cited in state SIP.

SIP Part 11 Figures and Equations

R 336.2158



QA/QC Test Or Specification	Acceptance Criteria	Frequency	Consequences If Not Met
Pre-test leak check	≤ 4% of target sampling rate.	Prior to sampling.	Sampling shall not commence until the leak check is passed.
Post-test leak check	≤ 4% of average sampling rate.	After sampling.	** See note below.
Ratio of stack gas flow rate to sample flow rate	Not more than 5% of the hourly ratios or 5 hourly ratios (whichever is less restrictive) may deviate from the reference ratio by more than ± 25%.	Every hour throughout data collection period.	** See note below.
Sorbent trap section 2 break-through	≤5% of section 1 mercury mass.	Every sample.	** See note below.
Paired sorbent trap agreement	≤ 10% relative deviation if the average concentration is > 1.0 microgram per cubic meter ($\mu g/m^3$). ≤ 20% relative deviation if the average concentration is ≤ 1.0 $\mu g/m^3$. Results are also acceptable if absolute difference between concentrations from paired traps is ≤ 0.03 $\mu g/m^3$.	Every sample.	Either invalidate the data from the paired traps or report the results from the trap with the higher mercury concentration.
Spike recovery study	Average recovery between 85% and 115% for each of the 3 spike concentration levels.	Prior to analyzing field samples and prior to use of new sorbent media.	Field samples shall not be analyzed until the percent recovery criteria have been met.
Multipoint analyzer calibration	Each analyzer reading within ± 10% of true value and $r^2 \geq 0.99$.	On the day of analysis, before analyzing any samples.	Recalibrate until successful.
Analysis of independent calibration standard	Within ± 10% of true value	Following daily calibration, prior to analyzing field samples.	Recalibrate and repeat independent standard analysis until successful.
Spike recovery from section 3 of sorbent trap	75–125% of spike amount.	Every sample.	** See note below.
RATA	Relative accuracy ≤ 20.0% or mean difference ≤ 1.0	For initial certification	Data from the system are invalidated until a

QA/QC Test Or Specification	Acceptance Criteria	Frequency	Consequences If Not Met
	µg/dscm for low emitters.	and annually thereafter.	RATA is passed.
Gas flow meter calibration	Calibration factor (Y) within ± 5% of average value from the most recent 3-point calibration.	At 3 settings prior to initial use and at least quarterly at 1 setting thereafter. For mass flow meters, initial calibration with stack gas is required.	Recalibrate the meter at 3 orifice settings to determine a new value of Y.
Temperature sensor calibration	Absolute temperature measured by sensor within ± 1.5% of a reference sensor.	Prior to initial use and at least quarterly thereafter.	Recalibrate. Sensor may not be used until specification is met.
Barometer calibration	Absolute pressure measured by instrument within ± 10 millimeters of mercury of reading with a mercury barometer.	Prior to initial use and at least quarterly thereafter.	Recalibrate. Instrument may not be used until specification is met.
**Note: If both traps fail to meet the acceptance criteria, the data from the pair of traps are invalidated. However, if only 1 of the paired traps fails to meet this particular acceptance criterion and the other sample meets all of the applicable QA criteria, the results of the valid trap may be used for reporting under this part, provided that the measured mercury concentration is multiplied by a factor of 1.111.			

$$R_{ref} = \frac{KQ_{ref}}{F_{ref}}$$

Where:

R_{ref} = Reference ratio of hourly stack gas flow rate to hourly sample flow rate.

K = Power of 10 multiplier, to keep the value of R_{ref} between 1 and 100. The appropriate K value will depend on the selected units of measure for the sample flow rate.

Q_{ref} = Average stack gas volumetric flow rate for first hour of collection period, standard cubic foot per hour (scfh).

F_{ref} = Average sample flow rate for first hour of the collection period, in appropriate units (for example, Liter per minute (L/min), cubic centimeter per minute (cc/min), dry standard cubic meter per minute (dscm/min)).

$$R_h = \frac{K Q_h}{F_h}$$

Where:

R_h = Ratio of hourly stack gas flow rate to hourly sample flow rate.

K = Power of 10 multiplier, to keep the value of R_h between 1 and 100. The appropriate K value will depend on the selected units of measure for the sample flow rate and the range of expected stack gas flow rates. Maintain the value of Rh within ± 25% of Rref throughout the data collection period.

Q_h = Average stack gas volumetric flow rate for the hour, (scfh).

F_h = Average sample flow rate for the hour, in appropriate units (for example, L/min, cc/min, dscm/min).

$$\% R = \frac{M_3}{M_s} 100$$

Where:

%R = Percentage recovery of the pre-sampling spike.

M_3 = Mass of mercury recovered from section 3 of the sorbent trap, (µg).

M_s = Calculated mercury mass of the pre-sampling spike, subrule(4)(a)(ii) of this rule,

(µg).

17 / 31

$$\%B = \frac{M_2}{M_1}\ 100$$

Where:
%B = Percent breakthrough.
M_2 = Mass of mercury recovered from section 2 of the sorbent trap, (µg).
M_1 = Mass of mercury recovered from section 1 of the sorbent trap, (µg).

(f) Calculation of mercury concentration. Calculate the mercury concentration for each sorbent trap, using the following equation:

$$C = \frac{M^*}{V_t}$$

Where:
C = Concentration of mercury for the collection period, (µg/dscm).
M* = Total mass of mercury recovered from sections 1 and 2 of the sorbent trap, (µg).
V_t = Total volume of dry gas metered during the collection period, (dscm). Standard temperature and pressure are defined as 20 degrees Celsius and 760 millimeters of mercury, respectively.

$$RD = \frac{|C_a - C_b|}{C_a + C_b}\ 100$$

Where:
RD = Relative deviation between the mercury concentrations from traps a and b, (percent).
C_a = Concentration of mercury for the collection period, for sorbent trap a, (µg/dscm).
C_b = Concentration of mercury for the collection period, for sorbent trap b, (µg/dscm).

R 336.2161

	Date	Time	Reference Gas Value µg/m^3	CEMS Measured Value µg/m^3	Absolute Difference	CE (% of Span Value)
Zero Level						
Mid Level						
High Level						

$$RD = \frac{|C_a - C_b|}{C_a + C_b} * 100$$

$$Concentration_{(dry)} = \frac{Concentration_{(wet)}}{(1 - B_{ws})}$$

$$\overline{d} = \frac{1}{n}\sum_{i=1}^{n} d_i$$

$$\sum_{i=1}^{n} d_i$$

$$S_d = \left[\frac{\sum_{i=1}^{n} d_i^{\,2} - \left[\frac{\sum_{i=1}^{n} d_i}{n}\right]^2}{n - 1}\right]^{1/2}$$

$$\sum_{i=1}^{n} d_i^{\,2}$$

$$\sum_{i=1}^{n} d_i$$

$$CC = t_{0.975}\frac{S_d}{\sqrt{n}}$$

t Values

n[a]	$t_{0.975}$
2	12.706
3	4.303
4	3.182
5	2.776
6	2.571
7	2.447
8	2.365
9	2.306
10	2.262
11	2.228
12	2.201
13	2.179
14	2.160
15	2.145
16	2.131

[a] Values already corrected for n-1 degrees of freedom.

n = Number of individual values.

$$RA = \frac{\left[\left|\overline{d}\right| + \left|CC\right|\right]}{\overline{RM}} * 100$$

R 336.2175

$$E = CF\ (\frac{20.9}{20.9 - \%O_2})$$

$$E = CF_c\ (\frac{100}{\%CO_2})$$