



Ohio Administrative Code

Rule 3745-17-03 Measurement methods and procedures.

Effective: January 20, 2018

[Comment: For dates and availability of non-regulatory government publications, publications of recognized organizations and associations, federal rules, and federal statutory provisions referenced in this rule, see paragraph (C) of rule 3745-17-01 of the Administrative Code titled "referenced materials."]

(A) For purposes of ascertaining, defining, and measuring ambient air quality, $PM_{2.5}$ and PM_{10} shall be measured by the methods specified in paragraphs (B)(20) and (B)(21) of rule 3745-17-01 of the Administrative Code. Such measurements for PM_{10} shall be corrected to standard conditions for purposes of comparing measurements with the ambient air quality standards set forth in rule 3745-25-02 of the Administrative Code.

(B) Emissions test methods and procedures for all new and existing sources.

(1) For the purpose of determining compliance with paragraph (A)(1) of rule 3745-17-07 of the Administrative Code, visible particulate emissions shall be determined according to the following:

(a) Except as provided in paragraph (B)(1)(b) of this rule, USEPA method 9 or continuous opacity monitoring as specified in paragraph (C) of this rule shall be employed.

(b) As an alternative to the compliance procedures specified in paragraph (B)(1)(a) of this rule, coal-fired boilers with heat input capacities equal to or greater than two hundred fifty million Btu per hour that are controlled with either baghouses or electrostatic precipitators may determine compliance with the visible particulate emission limitations specified in paragraph (A)(1) of rule 3745-17-07 of the Administrative Code through the use of continuous opacity monitoring data. The continuous opacity monitoring system shall comply with the requirements specified in 40 CFR 60.13 and shall be certified in accordance with "USEPA Performance Specification 1." (The continuous opacity monitoring system consists of all the equipment used to acquire data and includes the data recording/processing hardware and software.) During each calendar quarter, the permittee shall be



deemed in compliance with paragraph (A)(1) of rule 3745-17-07 of the Administrative Code if the following conditions are met:

(i) The nonexempt opacity values in excess of twenty per cent opacity are less than 1.10 per cent of the six-minute average opacity values. (Exempt opacity values are defined in paragraphs (A)(1)(b), (A)(2), and (A)(3) of rule 3745-17-07 of the Administrative Code.)

(ii) None of the nonexempt six-minute average opacity values exceeds sixty per cent.

(iii) The total amount of time, in hours, of exempt and nonexempt opacity values greater than twenty per cent and less than sixty per cent (not including start-up, shutdown, and malfunction exemptions provided in paragraphs (A)(2) and (A)(3) of rule 3745-17-07 of the Administrative Code) does not exceed the product of 0.10 times the actual number of hours the emissions unit was in operation during the calendar quarter.

In the event of a discrepancy between the continuous opacity monitoring data and any observations performed in accordance with paragraph (B)(1)(a) of this rule during the same time period, an evaluation may be performed by the Ohio EPA to assess the accuracy of the continuous opacity monitoring data (which may include an audit of the continuous opacity monitoring system performed in accordance with EPA 340/1-86-010 (recommended quality assurance procedures for opacity continuous emission monitoring systems) and "Acid Rain Program Continuous Emission Monitoring Systems (CEMS) Field Audit Manual" and the validity of the observations performed in accordance with paragraph (B)(1)(a) of this rule. The Ohio EPA may accept and utilize any data or observation it finds credible. The permittee is not precluded from using any credible evidence in defense of any enforcement action that may be initiated by the Ohio EPA.

(2) For the purpose of determining compliance with paragraph (B)(2) of rule 3745-17-07 of the Administrative Code, pertaining to visible particulate emissions from coke oven batteries:

(a) Charging operations:

(i) The charging period shall begin when the coal from the charging system starts to enter the oven and shall end when the last charge port lid is replaced. Such charging period shall not include the



period of time during which the port lids are reopened in order to sweep spilled coal into the oven.

(ii) The observer shall stand on the topside of the coke oven battery such that a good view of all charge ports of the oven being charged and the charging system is possible. The observer may change position to obtain a clear view of all oven ports, drop sleeves, and hoppers. During the charging period, the observer shall watch all the potential emission sources including the charge ports and the entire charging system. Upon observing the release of any visible particulate emission, an accumulative stopwatch shall be started. The watch shall be stopped when the visible particulate emission stops and shall be restarted when a visible particulate emission reappears. The observer shall continue this procedure for the entire charging period. If visible particulate emissions should occur simultaneously from several points during a charge, the visible particulate emissions shall be timed collectively as one continuous visible particulate emission. Furthermore, visible particulate emissions which may start from one source immediately after those from another source shall be timed as one continuous visible particulate emission. The following visible particulate emissions shall not be timed: steam vapor, visible particulate emissions from burning coal that is spilled on top of the oven or oven lid during charging, visible particulate emissions emitted from any equipment other than the charging system or charging ports, visible particulate emissions from closed standpipes during charging, visible particulate emissions emitted from coke oven doors which may rise above the battery and which may be windblown across its topside, and visible particulate emissions that drift from the top of the charging system, but have already been timed as a visible particulate emission from the drop sleeve below the hopper. The time recorded on the stopwatch shall represent the total time that visible particulate emissions are observed during a charge. The number of seconds of visible particulate emissions observed for each charge shall be recorded on a data sheet.

(iii) A minimum of six consecutive charges shall be observed and the time in seconds of visible particulate emissions during such charges shall be totalled. If the observations of a set of consecutive charges is interrupted by an event not in the control of an observer, then the data for the interrupted charges shall be discarded and additional charges shall be observed until the total number of consecutive charges equals at least six. For purposes of this paragraph, charges immediately preceding and following any interrupted or discarded charges shall be deemed consecutive.



(b) Offtake piping and charging hole lids:

(i) The observer shall walk down the length of the top of the battery and shall complete the inspection in an expeditious manner consistent with the safety of the observer. When safety conditions permit, the observer will walk near the center of the battery, but may deviate from this path to obtain a better view of any lid or offtake piping system. Separate traverses may be performed for offtake piping and charging hole lids. If the battery has two collector mains, the observer may make two traverses when observing visible particulate emissions from offtake piping. If an observer elects to make two traverses for a battery which has two collector mains, the observer shall inspect one collector main during the first traverse and inspect the other collector main during the second traverse. During each traverse, the observer shall record the time of the beginning and end of each traverse and the identity of any charging hole or offtake piping system having visible particulate emissions.

(ii) Visible particulate emissions from offtake piping shall include emissions from cracks or defects in the piping, emissions from the jointure of the battery to the standpipe, emissions from the standpipe to the gooseneck and gooseneck to the collector main, emissions from the seal between the gooseneck and gooseneck lid, and emissions from opened offtake lids. Visible particulate emissions from charging holes shall include emissions from the seal between the charging hole or stationary jumper pipe lid and its casting, emissions from the charging hole or stationary jumper pipe casting/battery interface, and emissions from opened charging holes or stationary jumper pipe lids. Visible particulate emissions which shall not be included are emissions caused by maintenance work in progress at an oven, emissions caused by the vaporization of wet luting materials, emissions caused by burning or smoldering excess topside coal, and emissions from charging ports and offtake piping during the charging operation. Visible particulate emissions from open offtake piping and charging holes, from a maximum of three ovens, shall be exempt. Regardless of the number of points from which visible particulate emissions are observed from any one offtake piping system, the maximum entry for any oven with a single offtake system shall be one and the maximum entry for any oven with two offtake piping systems shall be two. The maximum number of charging hole leaks recorded for any oven shall not exceed the number of charging holes on that oven.

(iii) The percentage of charging holes and offtake piping with visible particulate emissions shall be



determined by totalling the number of charging holes or offtake piping with visible particulate emissions, including that number of opened charging holes and offtake piping with visible particulate emissions which exceeds the amount which is allowed for three ovens, dividing that number by the total number of observed charging holes or offtake piping on operating ovens, and multiplying the result by one hundred per cent. For purposes of this paragraph, any oven which is not out of service for rebuild or maintenance work that is extensive enough to require the oven to be skipped in the charging sequence shall constitute an operating oven. Further, any opened charging hole or offtake piping lids on operating ovens shall be included as observed charging holes and offtake piping.

(c) Oven doors:

(i) The observer shall observe visible particulate emissions by completely walking around the coke oven battery at a steady distance from a position just outside the pusher machine and quencher car tracks as close to the battery as safety and visibility conditions permit. The observer shall traverse each side of a battery expeditiously, recording the time of the beginning and end of each side traverse, the identity of each door having visible particulate emissions, and the identity of any door not observable during the traverse. A visible particulate emission from an individual door shall be noted on an inspection sheet when an observer determines any visible particulate emissions are occurring from any location on the perimeter of a coke oven door or chuck door. Visible particulate emissions observed at the top of the battery above a specific oven door but not clearly attributable to such door shall not be counted in this procedure. An observer shall observe each oven door only once while scanning the perimeter for any visible particulate emissions. After a brief scan of an oven door, the observer shall move along his/her traverse, checking subsequent doors on the battery in a like manner. If a temporary machine obstruction occurs which blocks the view of a series of ovens, the ovens shall be bypassed and the remaining oven doors on that side of the battery shall be observed. After the traverse of such side of the battery, the bypassed oven doors and only those oven doors, may be reobserved. After completing one side, the observer shall proceed directly to the opposite side of the battery and proceed to perform a like traverse while repeating the above procedures. A row of two or more continuous batteries may be inspected by observing all of the pusher side doors and then all of the coke side doors.

(ii) The percentage of oven doors with visible particulate emissions shall be determined by totalling



the number of doors with visible particulate emissions, dividing that sum by the total number of observed doors on operating ovens, and multiplying the result by one hundred per cent. For purposes of this paragraph, any oven which is not out of service for a rebuild or maintenance work that is extensive enough to require that oven to be skipped in the charging sequence shall constitute an operating oven. Further, any doors that are removed from operating ovens shall constitute unobserved doors.

(d) For any pushing operations, visible particulate emissions shall be determined according to USEPA method 9 with the following modifications:

(i) Paragraph 2.5 ("Data Reduction") of USEPA method 9 shall not be used; and

(ii) Visible particulate emission readings shall be recorded at fifteen-second intervals during each pushing operation observed and the average reading during each such operation shall be determined by summing the opacity readings and dividing this sum by the number of observations during that pushing operation.

(3) For the purpose of determining compliance with paragraphs (B)(1), (B)(3), (B)(7)(a)(i), (B)(7)(b), (B)(7)(c), and (B)(8)(a) to (B)(8)(d) of rule 3745-17-07 of the Administrative Code, paragraphs (C)(3)(c), (D)(3), (F)(4)(c), (I)(1), (L)(3), (O)(1), (P)(2), (V)(4)(c), (W)(2), (X)(2), and (X)(3) of rule 3745-17-12 of the Administrative Code, or with paragraph (D)(4)(a) of rule 3745-17-13 of the Administrative Code, visible emissions of fugitive dust shall be determined according to USEPA method 9 with the following modifications:

(a) For paragraphs (B)(1), (B)(7)(b), (B)(7)(c), (B)(8)(b), (B)(8)(d), and (B)(9) of rule 3745-17-07 of the Administrative Code, the data reduction and average opacity calculation shall be based upon sets of twelve consecutive visible emission observations recorded at fifteen-second intervals.

(b) Opacity observations shall be made from a position that provides the observer a clear view of the source and the fugitive dust with the sun behind the observer. A position at least fifteen feet from the source is recommended. To the extent possible, the line of sight should be approximately perpendicular to the flow of fugitive dust and to the longer axis of the emissions. Except as provided in paragraphs (B)(3)(d) and (B)(3)(e) of this rule, opacity observations shall be made for the point of



highest opacity within the fugitive dust. Since the highest opacity usually occurs immediately above or downwind of the source, the observer should normally concentrate on the area of the plume close to the source. For purposes of paragraphs (B)(7)(b) and (B)(8)(b) of rule 3745-17-07 of the Administrative Code, observations shall be made where the fugitive dust plume is distinctly separate from the falling material and from the surface of the pile.

(c) [Reserved.]

(d) For paragraphs (B)(7)(a)(i), (B)(8)(a), and (B)(8)(c) of rule 3745-17-07 of the Administrative Code and paragraphs (I)(1), (O)(1), and (P)(2) of rule 3745-17-12 of the Administrative Code:

(i) A data set shall consist of twelve observations based on four uninterrupted vehicle passes, three observations per vehicle pass, using USEPA method 9. The initial observation shall be taken immediately after passage of the first vehicle, at the point of highest opacity within the fugitive dust, and at four feet above the surface of the roadway or parking area. Two additional observations shall be taken at the same point as the initial observation and at five seconds and ten seconds after the initial reading. The same procedure shall be conducted for the next three vehicle passes. If any interruption in observations during any vehicle pass occurs, the observations taken during that vehicle pass shall be discarded and the next vehicle pass shall be observed. For vehicle traffic on top of any material storage pile, the observer may observe passes of the same vehicle or vehicles, at identical or different points atop the pile, in order to obtain readings for four vehicle passes.

(ii) The data reduction and average opacity calculation shall be based upon the average of twelve observations in each data set.

(e) For paragraph (B)(7)(c) of rule 3745-17-07 of the Administrative Code, observations of fugitive dust resulting from a vehicle's movement upon a coal storage pile shall be made at a point no less than one vehicle length from the rear of the vehicle and at an elevation no lower than the maximum height of the vehicle. For purposes of this rule, vehicle length and height shall be based upon the length and height of the vehicle being observed.

(4) For the purpose of determining compliance with paragraphs (B)(4) to (B)(6), (B)(7)(a)(ii), and (B)(7)(d) of rule 3745-17-07 of the Administrative Code, paragraphs (B), (C)(1), (C)(2), (E), (F)(1)



to (F)(3), (K), (M)(1), (M)(2), (Q)(1), (S)(4)(b), (U)(1), (U)(2), (V)(1) to (V)(3), (W)(1), (X)(1), (X)(4), (Y)(1) to (Y)(3), and (Z) of rule 3745-17-12 of the Administrative Code, or with paragraph (B) of rule 3745-17-13 of the Administrative Code, visible emissions of fugitive dust shall be determined according to USEPA method 22 with the following modifications:

- (a) If the observer's view is obscured and observations shall be terminated prior to completing the necessary or desired observation period, the observer shall clearly note this fact on the observation form. When the observer's view of the source is no longer obscured, the observations shall recommence to complete the observation period.
- (b) The observer shall identify on the observation form all interruptions due to rest breaks.
- (c) For the purpose of determining compliance with the applicable visible emission limitation, the observations, excluding break periods and periods of obscured vision, shall be considered continuous.
- (d) For any roadway or parking area, the observer shall determine the presence and duration of visible particulate matter at the same point of the potential emissions and at a height approximately four feet above the surface of the roadway or parking area.
- (5) Visible particulate emission readings other than those referenced in paragraph (B)(4) of this rule shall be determined by observers qualified according to tests and procedures set forth in USEPA method 9.
- (6) The director may refuse to accept the results of emission tests conducted pursuant to paragraphs (B)(7) to (B)(10) of this rule which are not conducted with prior review and approval of the test specifications by the director. Test specifications shall be submitted for this purpose at least thirty days before the proposed test date. The director will advise an entity of any deficiencies in the proposed test specifications as expeditiously as practicable so as to minimize any disruption of the proposed testing schedule.
- (7) For the purpose of determining compliance with paragraphs (B)(3) and (B)(4) of rule 3745-17-08 of the Administrative Code:



- (a) The amount of particulate emissions shall be determined by the test methods specified in paragraph (B)(15) of rule 3745-17-01 of the Administrative Code.
- (b) For electric arc furnaces at iron foundries, steel foundries and iron and steel mills, the sampling and measurement of the particulate emissions shall be performed only during those operating intervals commencing with the addition of cold scrap to the furnace and ending with the completion of the tapping of the furnace.
- (c) For argon-oxygen decarburization vessels, the sampling and measurement of the particulate emissions shall be performed only during those operating intervals commencing with the pouring of hot metal into the vessel and ending with the completion of the tapping of the vessel.
- (d) For basic oxygen furnaces, the sampling and measurement of the particulate emissions shall be performed only during those operating intervals commencing with the addition of hot metal to the furnace and ending with the completion of the tapping of the furnace.
- (e) For hot metal transfer operations, the sampling and measurement of the particulate emissions shall be performed only during those operating intervals when hot metal is being poured.
- (f) For hot metal desulfurization operations, the sampling and measurement of the particulate emissions shall be performed only during those operating intervals commencing with the initial injection of the desulfurization agent into the hot metal and ending with the completion of the injection process.
- (g) For blast furnace casthouses, the sampling and measurement of the particulate emissions shall be performed only during the casting operation, commencing with the opening of the tap hole and ending one minute after the positioning of the mud gun to plug the tap hole.
- (h) For pushing operations at coke oven batteries, one point of a probe traverse shall be sampled during each pushing operation and the sampling and measurement of the particulate emissions shall be performed only during those operating intervals commencing with the first movement of the ram and ending with the full extension of the ram plus ten seconds or with the first movement of the quench car, whichever occurs first.



(8) For the purpose of determining compliance with rule 3745-17-09 of the Administrative Code:

(a) The amount of particulate emissions from an incinerator shall be determined by test methods specified in paragraph (B)(15) of rule 3745-17-01 of the Administrative Code. Emission tests shall be conducted at maximum burning capacity of the incinerator.

(b) The maximum burning capacity of an incinerator shall be the manufacturer's or designer's guaranteed maximum rate or such other rate as may be determined by the director in accordance with good engineering practices. In case of conflict, the determination made by the director shall govern.

(9) For the purpose of determining compliance with rule 3745-17-10 of the Administrative Code and paragraphs (N)(1), (N)(2), (O)(7), (O)(8)(a), (P)(1), (P)(7), and (P)(8) of rule 3745-17-12 of the Administrative Code:

(a) The amount of particulate emissions shall be determined by test methods specified in paragraph (B)(15) of rule 3745-17-01 of the Administrative Code, except that for USEPA method 5 the probe and filter holder heating systems in the sampling train shall be set to provide a gas temperature no greater than three hundred twenty degrees Fahrenheit (one hundred sixty degrees Celsius).

(b) The heat content of fuels shall be determined according to ASTM D5685-11 or ASTM E870-82(2013) for solid fuels, ASTM D240-14 for liquid fuels, and ASTM D1826-94(2010) for gaseous fuels.

(c) The ash content of coal shall be determined according to ASTM D3174-12.

(10) For the purpose of determining compliance with rule 3745-17-11 of the Administrative Code, paragraphs (C)(3)(b), (D)(2), (F)(4)(b), (F)(5), (G), (H), (I)(2) to (I)(14), (I)(16), (I)(17), (I)(19) to (I)(30), (I)(38) to (I)(40), (I)(43), (I)(45), (I)(46), (I)(48), (J), (L)(2), (M)(3), (N)(3), (N)(4), (O)(3) to (O)(6), (O)(9), (O)(10), (P)(3)(a), (P)(4) to (P)(6), (P)(10), (P)(11), (Q)(2), (R)(1), (S)(1) to (S)(4)(a), (T), (U)(3), (V)(4)(b), and (Y)(4) of rule 3745-17-12 of the Administrative Code, and paragraphs (D)(2), (D)(3), (D)(4)(b) to (D)(4)(d), (D)(5) and (D)(6) of rule 3745-17-13 of the Administrative Code:



(a) The amount of particulate emissions shall be determined by test methods specified in paragraph (B)(15) of rule 3745-17-01 of the Administrative Code.

(b) The controlled mass rate of particulate emissions from sources equipped with control equipment, or the uncontrolled mass rate of particulate emissions from sources not equipped with control equipment, shall be determined by sampling and other measurements made at the air contaminant source or sources prior to the point at which air contaminants are emitted to the ambient air. For sources equipped with control equipment, the uncontrolled mass rate of emission may be determined by either sampling in the stack upstream from the inlet of the control equipment or by the use of other techniques accepted by the director.

(c) For coke quench towers, the concentration of total dissolved solids in the quench water shall be determined according to Section 209(C), "Standard Methods for the Examination of Water and Wastewater," using a drying temperature between one hundred three and one hundred five degrees Celsius. Analyses shall be performed on grab samples of the quench water as applied to the coke. Samples shall be collected at a minimum of five days per week per quench tower and analyzed to report a weekly average concentration for each quench tower. Samples for each week shall be analyzed either:

(i) Separately, with daily concentrations determined and averaged as a weekly average, or

(ii) As one composite sample, with equal volumes of each day's sample combined to form the composite sample.

(C) Continuous emission monitoring requirements for measuring opacity for "Appendix P" facilities.

(1) Except as provided in paragraphs (D) and (E) of this rule, for any air contaminant source subject to 40 CFR part 51, appendix P, "Minimum Emission Monitoring Requirements," shall operate and maintain a continuous opacity monitoring system (COMS) for measuring opacity. The COMS shall comply with all specifications outlined in 40 CFR part 60, appendix B, "Performance Specification 1." The COMS shall be capable of providing external calibration filter access in accordance with



Section 5.1.9 of "USEPA Performance Specification 1."

(2) Any owner or operator of a facility that meets the applicability requirements specified in paragraph (C)(1) of this rule shall submit reports to the director of excess emissions for each calendar quarter within thirty days following the end of each calendar quarter. The reports shall include, but not be limited to, the times and values of all six-minute average readings of opacity above the applicable standard, along with the dates, magnitudes (per cent opacity), reasons (if known), and corrective actions taken (if any). In addition, the reports shall include the dates and times of each period during which the continuous emission monitoring system was inoperative, except for zero and span checks, and the nature of system repairs or adjustments.

(D) For any air contaminant source subject to 40 CFR part 51, appendix P, "Minimum Emission Monitoring Requirement" where the use of a COMS would not provide accurate determinations of opacity as described in Section 6.1 of 40 CFR part 51, appendix P, the owner or operator may elect to request, in writing, permission from the director and the administrator to install, calibrate, certify, maintain and operate a CEMS for measuring particulate emissions in lieu of complying with paragraph (C)(1) of this rule. Upon approval of the use of the CEMS by the director and the administrator, the air contaminant source shall comply with the following:

(1) The owner or operator shall install, operate and maintain a CEMS for particulate emissions that meets 40 CFR part 60, appendix B, performance specification 11 and the following:

(a) The owner or operator shall conduct a performance evaluation of the CEMS according to 40 CFR 60.13, performance specification 11, and appendix F, procedure 2.

(b) During each particulate emissions correlation testing run of the CEMS required by performance specification 11, particulate emissions and oxygen or carbon dioxide data shall be collected concurrently by both the CEMS and the performance tests conducted using the following:

(i) For particulate emissions, USEPA method 5 or 5B of 40 CFR part 60, appendix A shall be used.

(ii) For oxygen or carbon dioxide, USEPA method 3A or 3B of 40 CFR part 60, appendix A, shall be used.



(c) Quarterly accuracy determinations and the daily calibration drift tests shall be performed in accordance with 40 CFR part 60, appendix F, procedure 2. Relative response audits shall be performed annually and response correlation audits using one-hour test runs shall be performed every three years.

(2) Each air contaminant source that is equipped with a CEMS for particulate emissions in lieu of using COMS shall comply with a particulate emissions limit of 0.030 pounds of particulate emissions per million British thermal units of heat input, based upon a daily average, and any other mass emission limit that applies.

(3) Compliance with the daily average particulate emission limitation shall be determined by calculating the arithmetic average of all valid CEMS hourly emission rates for particulate emissions for each air contaminant source operating day.

(E) For any air contaminant source subject to 40 CFR part 51, appendix P, "Minimum Emission Monitoring Requirement" where the use of a COMS would not provide accurate determinations of opacity as described in 40 CFR part 51, appendix P, section 6.1, the owner or operator may elect to request, in writing, approval from the director and the administrator of an alternative monitoring plan for determining compliance with particulate emissions, in lieu of complying with paragraph (C)(1) of this rule. Upon approval of the use of the alternative monitoring plan by the director and the administrator, the air contaminant source shall comply with the following:

(1) The monitoring requirements and ranges of the parameters to be monitored shall be incorporated into the underlying federally enforceable permit-to-install and Title V permit as federally enforceable limits.

(2) The federally enforceable ranges of the parameters to be monitored shall be established such that, during the initial performance testing required under 40 CFR 60.8, performance testing required by permit, or other performance testing as required by law, USEPA method 5B testing shows the air contaminant source is complying with any particulate matter mass limit applicable to the air contaminant source while operating within those ranges.



(3) Each instance where any parameter required to be monitored under the alternative monitoring plan falls outside the federally enforceable ranges is considered a violation of the applicable particulate emissions limit, and shall be reported in quarterly excess emission reports required by the permit. The quarterly excess emission reports shall satisfy 40 CFR 60.7 and the permits and shall include, at a minimum, the following:

- (a) The date the parameter was outside of the range.
- (b) The time the parameter was outside of the range.
- (c) The value of the parameter during the period it was outside of the range.
- (d) The cause of the parameter to be outside of the range.
- (e) The corrective action taken to bring the parameter back into the federally enforceable range.