



COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

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Molly Joseph Ward
Secretary of Natural Resources

David K. Paylor
Director

(804) 698-4020
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MEMORANDUM

TO: Regional Directors; Director, Air Compliance; Director, Air Permits; Director, Air Data Analysis and Planning; Director, Air Quality Assessments; Director, Enforcement; Air Compliance Managers, Air Enforcement Manager; Air Permit Managers;

CC: Jeffrey Steers, Deputy Director of Central Office Operations

FROM: Michael G. Dowd, Director, Air Division 

SUBJECT: ACG-001: Guidance for the Use of a Diluent Cap for Continuous Emission Monitoring Systems (CEMS) Emission Calculations

DATE: February 23, 2015

Purpose:

The purpose of this guidance is to promote consistency and resource efficiency for stationary sources using CEMS to demonstrate compliance with air emissions standards and monitoring requirements. The goal is to clarify the applicability and use of a diluent cap to address data anomalies (i.e., data blow up and apparent excess emissions) as flue gas diluent concentrations approach zero. Although the information discussed in the background section below addresses the circumstances of three specific stationary sources (with one common owner/operator), the Virginia Department of Environmental Quality (DEQ) has determined it is appropriate to develop this state-wide policy in order to maintain a consistent approach for all facilities.

Background:

In 2013, Dominion converted its power stations at Altavista, Hopewell, and Southampton from principally coal fired facilities to biomass fired facilities. Since the conversion, CEMS data have indicated higher than anticipated emissions of certain criteria pollutants reported in units of lb/MMBtu. Dominion contends that these emissions are represented as being excessive due to the calculation method applied to the raw monitoring data (i.e., United States Environmental Protection Agency (EPA) F-factor equations typically include the flue gas diluent concentration in their denominator, so as this concentration approaches zero the result of the equation approaches infinity).

To remedy this issue for its biomass facilities, Dominion proposed to employ a CO₂ diluent cap of 5% for use in the EPA F-factor equations used for CO, NO_x and SO₂ and to implement these changes through modification of each station's CEMS QA/QC plan.¹ In support of its request, Dominion pointed to a similar request that was granted by EPA Region 3 for Dominion's Virginia City Hybrid Energy Center (VCHEC) allowing Dominion to use a diluent cap for compliance with the Mercury and Air Toxics NESHAP (MATS).² EPA, however, concluded that it did not have the authority to make this determination with respect to the biomass facilities because the relevant emissions limitations were not based on national emissions standards or test methods (e.g., those found in the New Source Performance Standards) but rather were the result of DEQ Best Available Control Technology (BACT) determinations. EPA stated that DEQ was in fact the agency which had the authority to grant an alternative test method for BACT limits³.

Also, in its letter requesting a diluent cap for the biomass facilities, Dominion asked that the cap apply at all times. However, as stated in both EPA's letter approving a diluent cap for VCHEC and as noted in a report dated 3/27/14 prepared for and submitted by Dominion in support of its request, the final MATS rule only spoke approving of the use of diluent caps during defined periods of start-up and shutdown.⁴ In the preamble to the MATS rule, EPA stated:

"[It] considered each comment and decided to allow use of default Carbon Dioxide values...but only for startup periods or shutdown periods..."

The rule requires EGU owners or operators to use actual CO₂ CEMS values for all other operating periods...

[T]he EPA expects the short duration of these transient events outside of startup and shutdown periods that could cause CO₂ to be below... default values to have little, if any, impact on the 30-boiler operating day rolling averages."⁵

Applicability:

This guidance is applicable in situations where:

- (1) There is a DEQ developed emission standard or a federal emission standard where EPA has deferred the decision regarding whether the use of a diluent cap is appropriate to DEQ;
- (2) A CEMS is used to determine compliance with the emission standard; and
- (3) The calculation wherein the CEMS data is converted to the form necessary to determine compliance with the emission standard includes a correction or adjustment for the flue gas diluent concentration (%O₂ or %CO₂)

¹ Dominion letters from S. Lawton to DEQ dated 12/5/2014 and C. Taylor to J. Hagedorn dated 4/10/2014

² EPA letter from D. Esher to C. Taylor dated 1/28/2014

³ EPA email from K. Garnett to W. Ball dated 11/10/2014

⁴ See page 5 of RMB Consulting & Research report dated 3/27/14

⁵ See FR Vol. 79, No. 223 / Wednesday, November 19, 2014 pg 68785. (5. Diluent Cap)

Implementation:

- (1) The use of a diluent cap is acceptable during periods of start-up and shutdown for any pollutant for which the stationary source utilizes CEMS to demonstrate compliance.
- (2) The diluent cap should be equivalent to a minimum CO₂ concentration of 5% or a maximum O₂ concentration of 14%, and when used, applicable pollutant emissions should be assumed to be and reported as calculated using 5% CO₂ (or 14% O₂) in EPA's F-factor equations.
- (3) During permit renewals or revisions, applicable permits for stationary sources eligible to use the CEMS diluent cap should be amended/revised such that the condition(s) addressing the operation of CEMS include a statement providing that the CEMS be operated "...as approved by the Director, XXX Regional Office" (or equivalent text). The agency-approved boilerplate CEMS conditions have been updated to include this text.
- (4) When reporting emissions to DEQ, stationary sources should identify periods of operation where a diluent cap was used. Such reports shall also include documentation that any such periods of operation occurred during a start-up or shutdown event.
- (5) Nothing in this policy should be interpreted to limit or prohibit the DEQ from determining what constitutes a start-up or shutdown event or evaluating compliance with any emission standard based upon CEMS data on a case-by-case basis.

Questions or comments on this guidance should be directed to the Office of Air Compliance Coordination or the Office of Air Permit Programs as appropriate.

Supporting Documentation



RECEIVED PRO
DEC 08 2014

BY U.S. CERTIFIED MAIL

December 5, 2014

Mr. David J. Brown
Air Permit Manager
Blue Ridge Regional Office
Virginia Department of Environmental Quality
7705 Timberlake Road
Lynchburg, VA 24502

Mr. James Kyle
Air Permit Manager
Piedmont Regional Office
Virginia Department of Environmental Quality
4949-A Cox Road
Glen Allen, VA 23060

Mr. Troy Breathwaite
Air Permit Manager
Tidewater Regional Office
Virginia Department of Environmental Quality
5636 Southern Blvd.
Virginia Beach, VA 23462

RE: Request for Allowed Use of CO₂ Diluent Caps for Altavista Power Station, DEQ Air Reg. No. 30859; Hopewell Power Station, DEQ Air Reg. No. 51019; and Southampton Power Station, DEQ Air Reg. No. 61093

Dear Messrs. Brown, Kyle, and Breathwaite:

This letter is sent on behalf of Virginia Electric and Power Company, d/b/a Dominion Virginia Power (Dominion) to request that the Virginia Department of Environmental Quality (DEQ) allow the use of a 5% CO₂ diluent cap for all pollutants (NO_x, SO₂, and CO) that are monitored using continuous emissions monitoring systems (CEMS) at Dominion's Altavista, Hopewell, and Southampton Power Stations. Attached to this letter is Dominion's April 10, 2014 letter to US EPA Region III requesting approval of the diluent cap for these facilities. The attached letter includes a white paper by RMB Consulting and Research, Inc. detailing why the diluent cap is necessary and the diluent cap approval letter from US EPA Region III for Dominion's Virginia City Hybrid Electric Center facility in Wise County, Virginia dated January 28, 2014.

Dominion submitted applications to amend the PSD permits for each of the subject facilities dated April 3, 2014. One of the requests in each of those applications was to allow the use of a 5% CO₂ diluent cap for all pollutants monitored with CEMS. This request was not specific to any pollutant, but meant to cover all pollutants monitored with CEMS. Since the conversion of these three facilities

to biomass, CEMS data have indicated higher than anticipated emissions of certain criteria pollutants reported in units of pounds per million Btu (lb/mmBtu). Evaluation of the process, monitoring systems, and data management systems lead us to conclude that these emissions are artificially and unrealistically represented as higher than expected during startup and shutdown of the electric generating units due to an artifact in the formula which is required to calculate emissions from the raw monitoring data. US EPA has recognized this issue where low concentration of CO₂ during startup and shutdown leads to artificially inflated values for emissions parameters expressed in lb/mmBtu. In recognition of this, EPA has allowed the use of a diluent cap for CO₂ in Part 75 calculations and in the Mercury and Air Toxics NESHAP.

Shortly following these permit amendment applications, Dominion submitted the above-referenced April 10, 2014 letter to US EPA Region III requesting that it approve the use of a 5% CO₂ diluent cap for all pollutants monitored with CEMS. A copy of that letter is enclosed. US EPA Region III forwarded the request to EPA's Office of Air Quality Planning and Standards (OAQPS) for direction. On November 10, 2014, OAQPS responded that it did not have the authority to grant the request, because it is tied specifically to permitted emissions limitations rather than national emissions standards or test methods, such as those found in a New Source Performance Standard (NSPS). OAQPS stated, based on discussions with US EPA Region III, that the DEQ has the authority for granting an alternative test method to demonstrate compliance with permitted limitations, such as allowing the use of a diluent cap. A copy of OAQPS's November 10, 2014 email from Kim Garnett, OAQPS to Wesley A. Ball, Dominion, stating this position is also enclosed with this letter.

Dominion had received approval from US EPA to retroactively utilize a diluent cap at our Virginia City Hybrid Electric Center facility in Wise County, Virginia. Dominion and the DEQ chose to implement the diluent cap through the facility's monitoring plan. We propose to use the same approach with the Altavista, Hopewell, and Southampton Power Stations.

Therefore, in accordance with our April 10, 2014 request to US EPA Region III, Dominion proposes and requests DEQ approval of the following:

- Employ a CO₂ diluent cap of 5% in the calculation of all parameters (NO_x, SO₂, and CO) reported in lb/mmBtu from the Altavista, Hopewell, and Southampton power stations;
- Make these calculations retroactive to the dates at which each unit came online from an air permit compliance perspective as follows:
 - Altavista: Boiler 1 – September 6, 2013; Boiler 2 – September 7, 2013
 - Hopewell: Boiler 1 – October 6, 2013; Boiler 2 – October 8, 2013
 - Southampton: Boiler 1 – November 19, 2013; Boiler 2 – November 16, 2013; and
- Implement these changes through modification of each facility's Continuous Emissions Monitoring Systems Quality Assurance/Quality Control Plan.

Dominion would also request that DEQ continue to process the existing PSD Permit modifications for the above listed facilities in an expeditious manner. Dominion is committed to pursuing these permit modifications in order to resolve the outstanding issues at these facilities.

Messrs. Brown, Kyle, and Breathwaite
December 5, 2014
Page 3

If you have any further questions regarding these requests or need additional information, please call Mr. Andy Gates at (804) 273-2950.

Sincerely,

A handwritten signature in cursive script, appearing to read "Scott Lawton", with a long horizontal flourish extending to the right.

Scott Lawton
Director, Electric Environmental Business Support

Enclosures

cc: Ms. Tamera Thompson
Director of Air Permitting
Virginia Department of Environmental Quality
P.O. Box 1105
Richmond, VA 23218

Dominion Resources Services, Inc.
5000 Dominion Boulevard, Glen Allen, VA 23060
Web Address: www.dom.com



BY U.S. MAIL, RETURN RECEIPT REQUESTED

October 10, 2014

Ms. Kim Garnett, Engineer
U.S. EPA/OAQPS/MTG (E143-02)
109 TW Alexander Drive
Research Triangle Park, NC 27711

Re: Proposal to use a CO₂ diluent cap for calculating continuously monitored criteria pollutants at Dominion Altavista Power Station, Dominion Hopewell Power Station, and Dominion Southampton Power Station.

Dear Ms. Garnett:

In a letter dated April 10, 2014, Dominion Resources proposed using a CO₂ diluent cap of 5% in the calculation of all parameters reported in lb/MMBtu from the Altavista, Hopewell, and Southampton power stations, retroactive to the dates at which each EGU was required to be in compliance with its air permit emissions limitations. Dominion is providing additional information in response to the items noted in your email to Mr. Glenn Johnson dated August 1, 2014.

The requested diluent cap would apply at all times to three criteria pollutants that are continuously monitored, nitrogen oxides (NO_x), sulfur dioxide (SO₂) and carbon monoxide (CO). Use of a diluent cap is defined in 40 CFR Part 75. Alternative methods are mentioned in 40 CFR Subpart Db, specifically, §60.47b(a) and §60.48b(b)2.

Files containing typical operating, startup, and shutdown data for each unit are attached. These spreadsheets contain emissions data, load data, and the type of fuel being combusted. Also attached are files for each unit indicating where calculated exceedances of NO_x, SO₂ and CO limits on a lb/MMBtu basis occurred.

If you have questions, please contact Alan Ball at (804) 273-3912.

Regards,

A handwritten signature in cursive script, appearing to read "Cathy C. Taylor".

Cathy C. Taylor

Director, Electric Environmental Services



BY U.S. MAIL, RETURN RECEIPT REQUESTED

April 10, 2014

Mr. James W. Hagedorn
Air Compliance Manager
U.S. EPA Region III
1650 Arch Street
Philadelphia, PA 19103-2029

Re: Proposal to use a CO₂ diluent cap for calculating continuously monitored criteria pollutants at Dominion Altavista Power Station, Dominion Hopewell Power Station, and Dominion Southampton Power Station.

Dear Mr. Hagedorn:

In 2001, Dominion Resources purchased three power stations (i.e. Altavista, Hopewell, and Southampton) in Virginia. All electric generating units (EGUs) at these stations were originally designed and constructed to burn coal and were subject to EPA's Subpart Da New Source Performance Standard (NSPS). To enhance the company's renewable energy portfolio, Dominion converted all EGUs at these power stations to burn biomass in 2013. Since Subpart Da is applicable only to fossil fuel-fired steam electric generating units, the three stations are no longer subject to Subpart Da. Rather, the biomass-fired units are subject to Subpart Db (NSPS). Prior to the fuel conversion, all applicable air permits were issued by the Virginia Department of Environmental Quality. New and modified emission limits and monitoring requirements, associated with the conversion to biomass, were established for the affected EGUs.

Since the conversion to biomass, CEMS data have indicated higher than anticipated emissions of certain criteria pollutants reported in units of pounds per million Btu (lb/MMBtu). Evaluation of the process, monitoring systems, and data management systems lead us to the conclusion that these emissions are artificially represented as being excessive due to the manner in which they are calculated from the raw monitoring data. Dominion retained RMB Consultants to assist in validating this finding and identify potential solutions. A report summarizing the calculation methodology for the affected parameters and RMB's conclusions and recommendations is attached.

Based upon our findings and the recommendations of RMB, Dominion proposes the following means of remedying this issue:

- Employ a CO₂ diluent cap of 5% in the calculation of all parameters reported in lb/MMBtu from the Altavista, Hopewell, and Southampton power stations;
- Make these calculations retroactive to the dates at which each EGU came online from an air permit compliance perspective as follows:

- Altavista: Boiler 1 – September 6, 2013; Boiler 2 – September 7, 2013
- Hopewell: Boiler 1 – October 6, 2013; Boiler 2 – October 8, 2013
- Southampton: Boiler 1 – November 19, 2013; Boiler 2 – November 16, 2013;
and
- Implement these changes through modification of each facility's Continuous Emissions Monitoring Systems Quality Assurance/Quality Control Plan.

The diluent cap that Dominion is proposing is not without precedent in Region III. On January 28, 2013, EPA Region III granted a similar request for Dominion's Virginia City Hybrid Energy Center (copy attached). We believe this, along with the examples provided in the RMB report, provides a sound case for acceptance of this proposal

We look forward to receiving your feedback on this proposal and are willing to meeting with you in person or by conference call should you wish to do so. If you have any questions or would like to discuss this further, please contact Glenn Johnson at (804) 273-2946 or email Glenn.P.Johnson@com.com.

Sincerely,



Cathy C. Taylor

Director, Electric Environmental Services

Cc: Mr. Michael Dowd
Mr. Todd Alonzo
Ms. Tamara Thompson
Virginia Department of Environmental Quality
Central Office

Mr. Jed Brown
Mr. Frank Adams
Virginia Department of Environmental Quality
Blue Ridge Regional Office

Mr. Kyle Winter
Virginia Department of Environmental Quality
Piedmont Regional Office

Mr. Troy Breathwaite
Mr. John Brandt
Virginia Department of Environmental Quality
Tidewater Regional Office

Mr. James W. Hagedorn – EPA R3
April 10, 2014
Page 3

Please scan signed original/attachments and name file as: **Biomass CO2 Diluent Cap Proposal 04-10-2014.pdf**

ebc: Pam Faggert
Ed Baine
Frank Brayton ✓
Sidney Bragg ✓
Christy Armitage ✓
David Nuckols ✓
Ray McCreight ✓
Karen Canody
Ken Roller
Andy Gates ✓
Liz Willoughby ✓
Glenn Johnson ✓
Alan Ball ✓

RMB Report

INVESTIGATION OF EMISSION DATA BLOW UP

Dominion's Biomass Facilities

Altavista Power Station

Hopewell Power Station

Southampton Power Station

Prepared for
Dominion Generation
5000 Dominion Boulevard
Glen Allen, VA 23060

Prepared by
Ralph L. Roberson, P.E.
RMB Consulting & Research, Inc.
5104 Bur Oak Circle
Raleigh, NC 27612

March 27, 2014

UNDERSTANDING AND ILLUSTRATING DATA BLOW UP

The phenomenon we term data “blow-up” occurs from using one of EPA’s F-factor equations to convert pollutant concentration measurements to units of the emission standard (lb/10⁶ Btu) when the carbon dioxide (CO₂) concentration is low (typically ≤ 2 percent). Probably the most widely used EPA F-factor equation by steam electric generating units is as follows.

$$E = C_w \times F_c \times \frac{100}{CO_{2w}}$$

Where:

E = pollutant (NO_x, SO₂, CO, Hg or PM) emission rate, lb/10⁶ Btu

C_w = pollutant (NO_x, SO₂, CO, Hg or PM) concentration, wet basis, lb/dscf

F_c = volume of CO₂ produced per unit of heat input; equals 1,920 scf/10⁶ Btu for wood/bark fuel.

CO_{2w} = concentration of CO₂ in flue gas, wet basis, %.

A fundamental premise of mathematics dictates that as the denominator of the above equation (percent CO₂) approaches zero, the resulting quotient approaches infinity. This infinitely large multiplier will likewise drive the calculated pollutant emission rate toward infinity regardless of the value of the pollutant concentration. This concept is illustrated graphically in Figure 1 by plotting the conversion of three individual but constant pollutant concentrations, in parts per million (ppm), to lb/10⁶ Btu units, as a function of CO₂ concentrations.

It should be noted that the same blow-up phenomenon exists for monitoring systems that use O₂ as the diluent measurement instead of CO₂. As can be seen from the F-factor equation below, when the O₂ concentration approaches 20.9 percent (which occurs during low firing rate situations) the denominator approaches zero and the calculated emission rate tends to blow up.

$$E = C_d \times F_d \times \frac{20.9}{(20.9 - \%O_{2d})}$$

Where:

E = pollutant (NO_x, SO₂, CO, Hg or PM) emission rate, lb/10⁶ Btu

C_d = pollutant (NO_x, SO₂, CO, Hg or PM) concentration, dry basis, lb/dscf

F_d = volume of combustion products produced per unit of heat input; equals 9,600 scf/10⁶ Btu for wood/bark fuel.

O_{2d} = concentration of O₂ in flue gas, dry basis, %.

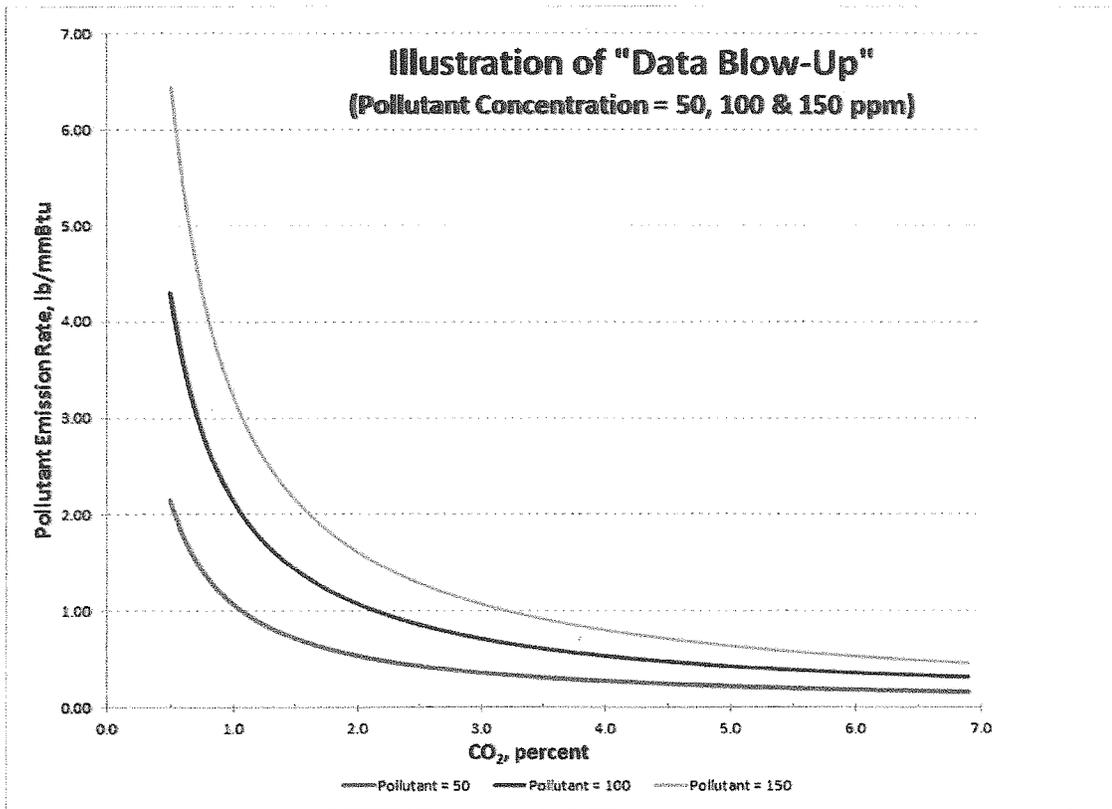


Figure 1. Illustration of Data Blow-Up

As Figure 1 clearly demonstrates, as CO₂ concentrations drop below about two percent, the resulting pollutant emission rates, expressed in lb/10⁶ Btu, tend to “blow up.” As context for Figure 1, it is informative to recognize that during normal operation the flue gas from the Dominion Biomass Units typically exhibit CO₂ concentrations ranging from 10 to 12 percent.

SUMMARY OF AFFECTED FACILITIES

A non-regulated utility company constructed three power stations (i.e., Altavista, Hopewell and Southampton) in Virginia in the 1990's. All the affected units were originally designed and constructed to burn coal. As such, all of the units were subject to EPA's Subpart Da New Source Performance Standard (NSPS). Dominion Resources purchased the three plants in 2001. To enhance Dominion's renewal energy portfolio, Dominion converted all of the units to burn biomass in 2013. Since Subpart Da is applicable only to fossil-fuel-fired steam electric generating units, the three plants are no longer subject to Subpart Da. Rather, the biomass-fired units are subject to EPA's Subpart Db (NSPS).

HISTORICAL ELECTRIC UTILITY OPERATIONS

Historically, boiler owner/operators have been able to deal with data blow up by using one of two approaches. First, data blow-up events are typically associated with unit start-ups and

shutdowns. Under the general provisions of EPA's New Source Performance Standards (NSPS) owner/operators were able to report blow-up events as excess emissions and provide a reason code of unit start-up, shutdown or malfunction.¹ Also, the initial Subpart Da NSPS defined a boiler operating day (BOD) to be a 24-hour period during which fuel was combusted the entire 24 hours.² Thus, most any calendar day that contained a boiler start-up was, by definition, excluded because such days did not meet the definition of a BOD. However, EPA modified the definition of a BOD for units that commenced construction after February 28, 2005. The current definition of a BOD under Subpart Da and a *steam generating unit operating day* under Subpart Db is a 24-hour period between midnight and the following midnight during which fuel is combusted any time.³ Thus, the start-up/shutdown exemptions are no longer available to units subject to EPA's most recent revisions to the Subpart Da and Db NSPS. More specifically, § 60.48Da(a) states that for units that commenced construction after May 3, 2011 the SO₂ emission limit under § 60.43Da and the NO_x emissions limit under § 60.44Da apply at all times. Likewise § 60.44b(h) states that the NO_x standards under this section apply at all times including periods of startup, shutdown, or malfunction.

The second approach for mitigating the impact of data blow-up is by using what is referred to as a "diluent cap." This procedure is defined in the 40 C.F.R. 75 regulations and permits the use of a diluent cap (five percent CO₂ or 14 percent for O₂) for the purpose of reporting emissions to EPA's Clean Air Markets Division (CAMD). Although the use of a diluent cap was initially limited to periods defined as start-up and shutdown, EPA later expanded the concept to include any period during which measured CO₂ fell below the five percent, or O₂ rose above the 14 percent cap.

It might be argued that the Subpart Da and Db new source performance standard (NSPS) implicitly allows the use of the diluent cap for monitoring SO₂ and NO_x emissions. For example, 40 CFR 60.47b(a) states:

If the owner or operator has installed and certified a SO₂ and O₂ or CO₂ CEMS according to the requirements of § 75.20(c)(1) of this chapter and appendix A to part 75 of this chapter, and is continuing to meet the ongoing quality assurance requirements of § 75.21 of this chapter and appendix B to part 75 of this chapter, those CEMS may be used to meet the requirements of this section, provided that:

- (1) When relative accuracy testing is conducted, SO₂ concentration data and CO₂ (or O₂) data are collected simultaneously.

Likewise, 40 CFR 60.48b(b)(2) states:

If the owner or operator has installed a NO_x emission rate CEMS to meet the requirements of part 75 of this chapter and is continuing to meet the ongoing quality assurance requirements of part 75 of this chapter, that CEMS may be used

¹ Note that section 60.8(c) states, *operation during periods of startup, shutdown and malfunction shall not constitute representative conditions for the purpose of a performance test nor shall emissions in excess of the level of the applicable emission limit during periods of startup, shutdown and malfunction be considered a violation of the applicable emission limit.*

² 44 Fed. Reg., 33,614 (June 11, 1979).

³ 71 Fed. Reg., 9,876 (February 27, 2006).

to meet the requirements of this section, except that the owner or operator shall also meet the requirements of § 60.49b.

Clearly, the EPA staff that developed the Subpart Db NSPS is aware of the existence of the Part 75 monitoring requirements and makes reference to them in several paragraphs. While the two above-cited paragraphs indicate that complying with Part 75 CEMS requirements is sufficient for Part 60 purposes, neither paragraph suggests that the Part 75 diluent caps should not be used or included for Part 60 reporting.⁴

RECENT EPA RULEMAKING ACTIONS

On May 3, 2011, EPA's proposed National Emission Standards for Hazardous Air Pollutants from Coal- and Oil-fired Electric Utility Steam Generating Units were published in the Federal Register.⁵ This rule has become known as the Mercury and Air Toxics Standards "MATS" rule). Within the MATS rule, EPA proposed to require compliance with the emission limits "at all times", including periods of start-up and shutdown.⁶ However, EPA recognized the inappropriateness of using measured diluent concentrations during start-up and shutdown and proposed to allow the use of diluent default values for all input-based emission limits during those periods. Although the diluent cap proposed in the MATS rule was different than the above-discussed cap under Part 75, the proposed appeared both reasonable and capable of resolving the data blow-up conundrum.

When EPA finalized the MATS rule, the Agency adopted work practice standards and exempted emissions during defined periods of start-up and shutdown from compliance calculations.⁷ While EPA did not include the default values in the final MATS rule, the Agency continued to recognize the need for such a cap in reporting some input-based emission values. Specifically, in the procedures for calculating mercury (Hg) emission rates in pounds per trillion Btu heat input (lb/TBtu), EPA provided for use of the Part 75 diluent cap for start-up and shutdown as follows:

for startup and shutdown hours, you may calculate the Hg emission rate using the applicable diluent cap value specified in section 3.3.4.1 of appendix F to part 75 of this chapter, provided that the diluent gas monitor is not out-of-control and the hourly average O₂ concentration is above 14.0% O₂ (19.0% for an IGCC) or the hourly average CO₂ concentration is below 5.0% CO₂ (1.0% for an IGCC), as applicable.⁸

Because the Hg emission values must be reported for all periods of EGU operation, including start-up and shutdown, use of the diluent cap to correct these values is important even if the values are not used in compliance calculations.

⁴ The use of substitute data derived from missing data procedures and the use of bias adjusted data obtained by applying bias adjustment factors according to the procedures of Part 75 are specifically excluded for Part 60 data reporting. See, for example, § 60.49Da(b)(4)(iii) and § 60.49Da(c)(2).

⁵ 76 Fed. Reg., 24976 (May 3, 2011).

⁶ 76 Fed. Reg. 25103 (May 3, 2011).

⁷ 77 Fed. Reg. 9304 (February 16, 2012).

⁸ 77 Fed. Reg. 9506 (February 16, 2012).

OTHER PRECEDENTS FOR APPLYING DILUENT CAPS EXIST

In October 2002, the owner/operator of Mirant Kendall facility, located in Cambridge, MA asked EPA to approve several alternative procedures to the CEMS quality assurance/quality control (QA/QC) requirements affecting the facility. The Kendall facility is a repowering project that consists of a 170 MW General Electric combustion turbine generator (CTG) that operates in a combined cycle configuration. The exhaust of the CTG is directed into a heat recovery steam generator (HRSG), which is equipped with duct burners. The facility is permitted to burn natural gas, but is allowed to use low sulfur distillate oil as a backup fuel for no more than 720 operating hours per year. Among other things, EPA approved the use of the O₂ diluent cap in accordance with 40 C.F.R. Part 75, Appendix F, Section 3 for converting NO_x and CO concentration measurements (ppm) to units of the emission limit, lb/10⁶ Btu.⁹

In 2012, DTE Energy petitioned EPA Region V to allow the use of the CO₂ diluent cap for Greenwood Unit 1. Greenwood Unit 1 is a large (~850 MW) utility boiler that primarily burns natural gas. The unit is subject to EPA's Subpart D new source performance standards (NSPS). As such, NO_x data blow-up events were historically handled through the start-up/shutdown/malfunction provisions codified as 40 C.F.R. 60.8(c).¹⁰ Recently, DTE was challenged to operate the Greenwood unit for extended periods of time at low (55 – 58 MW) loads.¹¹ In this new operating regime, DTE experienced NO_x blow-up events that could not be ascribed to start-ups or shutdowns, even though the cause of the NO_x spikes was the same (i.e., low CO₂ concentration) as during periods of start-up or shutdown. EPA Region V recently approved the use of the CO₂ diluent cap for Greenwood Unit 1 whenever CO₂ concentrations fall below five percent.

More recently, Dominion Energy petitioned EPA Region III to allow the use of the CO₂ diluent cap for the Virginia City Hybrid Energy Center (VCHEC). The two VCHEC units are subject to EPA's Subpart Da NSPS. In its petition, Dominion explained that the apparent spikes in emissions calculated during start-up and shutdown activities were not real but the result of low CO₂ concentrations which in turn resulted in data blow up. Based upon guidance provided by EPA Headquarters, Region III approved the use of a 5 percent cap on CO₂ emissions during start-up and shutdown events.¹²

CONCLUSIONS AND RECOMMENDATIONS

The apparent spikes in calculated emission rates observed during start-up and shutdown of the Dominion Biomass units are not real, (or are greatly inflated), but rather a result of data blow up caused by low CO₂ concentrations. The simplest and most obvious solution to the data blow-up

⁹ Letter from Ken Moraff, EPA Enforcement Manager to Shawn Konary, Director of Environmental Affairs, Mirant Kendall, dated October 11, 2002.

¹⁰ Section 60.8(c) states that, among other things, emissions in excess of the level of the applicable emission limit during periods of start-up, shutdown and malfunction shall not be considered a violation of the applicable emission limit unless otherwise specified in the applicable standard.

¹¹ To support utilizing more wind energy, DTE was challenged with operating Greenwood at low load so that the unit could be quickly ramped up to backfill supply when the wind suddenly stops blowing.

¹² Letter from Diana Esher, Region III Director of Air Protection Division to Cathy Taylor, Director of Electric Environmental Services, Dominion Resources, dated January 28, 2014.

issues for the Dominion Biomass units is to allow use of the CO₂ diluent cap when CO₂ falls below five percent. This would resolve the data blow-up issue and be a straightforward approach to implement as the DAS at each Biomass Facility were originally programmed to use the diluent cap approach because all of the units were subject to 40 C.F.R. 75 reporting requirements prior to converting to biomass fuels.

**EPA Diluent Cap Approval Letter for
Virginia City Hybrid Energy Center**



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029**

REC'D JAN 5 1 2014 ABF

Ms. Cathy C. Taylor, Director
Electric Environmental Services
Dominion Resources Services, Inc.
5000 Dominion Boulevard
Glen Allen, Virginia 23060

JAN 28 2014

Re: Request for Carbon Dioxide Diluent Cap at Virginia City Hybrid Energy Center

Dear Ms. Taylor:

The Philadelphia Regional Office of the U.S. Environmental Protection Agency (Region III) Air Protection Division received and reviewed your letter, dated May 6, 2013, requesting a modification to Part 60, Subpart Da at the Dominion Resources Hybrid Energy Center (DHEC) located in Wise County, Virginia. Modifications to monitoring that serves as a compliance test have the potential to impact facilities across the country. As a result, this response was coordinated with personnel from both EPA's Office of Air Quality Planning and Standards (OAQPS) and Washington, D.C. offices.

Your May letter requested a determination on three issues: (1) the institution of a 5% cap (default value) on the amount of CO₂ for use in the F factor equation utilized in the utility industry for converting criteria pollutant emission values to pounds per million BTUs (Equation 19-7 in Method 19, 40 CFR 60, Appendix A) during periods of boiler startup and shutdown, (2) making the determination on a CO₂ "cap" retroactive to the startup of the Hybrid Energy Center, which was September 1, 2012, for compliance purposes and (3) implementation of these changes by modifying the Hybrid Energy Center's continuous monitor quality assurance/quality control plan.

Based on recent guidance received by Region III from OAQPS (attached), dated December 16, 2013, (OAQPS memo) Region III is, hereby, approving the use of a default value of 5% for CO₂ during periods of boiler startup and shutdown provided that DHEC follows the conditions specified in the OAQPS memo. Region III also approves making this determination retroactive to the startup of the Hybrid Energy Center which occurred in September, 2012. The necessary changes to DHEC's CEMs QA/QC plan to incorporate the approved modifications are also, hereby, approved. This determination was made based on data supplied to EPA for the DHEC facility and cannot be used at another facility without prior approval from EPA.



If you should have any further questions or comments in regard to this matter, do not hesitate to contact James Hagedorn, of the Air Protection Division, at (215) 814-2161, or Robin Segall, of our OAQPS office, at (919) 541-0893.

Sincerely,



Diana Esher, Director
Air Protection Division

Cc: Robin Segall, RTP
Crystal Bazyk, VaDEQ-Abingdon Office

Attachment





UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

DEC 16 2013

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

MEMORANDUM

SUBJECT: Approval for Use of Carbon Dioxide (CO₂) 'Diluent Cap' in Continuous Emissions Monitoring of Particulate Matter (PM), Nitrogen Oxides (NO_x), Carbon Monoxide (CO), and Sulfur Dioxide (SO₂) at Dominion Resources' Virginia City Hybrid Energy Center

FROM: Conniesue B. Oldham, Ph.D., Group Leader
Measurement Technology Group (E143-02)

TO: James W. Hagedorn, Air Enforcement Branch
U.S. EPA Region 3

Thank you for your request for us to review and issue a determination on an alternative test method request dated May 6, 2013, that you received from Dominion Resources (Dominion) for their Virginia City Hybrid Energy Center (VCHC) in Wise County, Virginia. As we understand it, VCHC is subject to the requirements of 40 CFR Part 60, Subpart Da, Standards of Performance for Electric Utility Steam Generating Units for Which Construction is Commenced After September 18, 1978. As such, VCHC is required to conduct continuous monitoring of PM, NO_x, and SO₂ and, because this monitoring is serving as the compliance test method under this subpart, OAQPS must make an alternative test method determination regarding any proposed modifications to the required monitoring procedures.

In their request, Dominion explains that, since coming online in 2012 and during periods of boiler startup and shutdown, the continuous emissions monitoring systems (CEMS) at VCHC indicate higher than anticipated emissions for those criteria pollutants reported in pounds per million Btu (lb/MMBtu). Upon evaluation of the VCHC process, monitoring systems, and data management systems, Dominion has come to the conclusion that the emissions are being artificially overstated during startup and shutdown due to the manner in which they are calculated from the raw data to yield results in lb/MMBtu. In particular, Dominion contends that the use of the F-factor equation (Eq. 19-7 in Method 19, 40 CFR 60, Appendix A) when the CO₂ concentration is low (≤ 5 percent) results in a "blow up" of the emission rate calculated; because, as the denominator (CO₂ concentration) in the equation approaches zero, the emission concentration goes to infinity. Dominion's request includes an illustration of the equation curves for three pollutant concentration levels (50, 100, and 150 ppm) which show an inflection in the area below 5 percent CO₂. Dominion's letter goes on to request use of a CO₂ "diluent cap" of 5.0 percent¹ in the calculation of all parameters reported in lb/MMBtu from the VCHC facility. It is our understanding that

¹ In 40 CFR 72.2, *diluent cap value* has been defined as "...a default value of percent CO₂ or O₂ which may be used to calculate the hourly NO_x emission rate, when the measured hourly average percent CO₂ is below the default value..."

these parameters would be PM, SO₂, NO_x, and CO. Though mentioned in the attachment to Dominion's letter of request and reported in lb/MMBtu, the mercury emissions from this facility are not regulated under Subpart Da or currently regulated under any other federal rule in 40 CFR Part 59, 60, 61, 63, or 65, and thus we do not have the authority to approve alternatives to the VCHEC's mercury monitoring requirements. There is, however, a provision in the May 24, 2011, permit as amended October 23, 2012 (Provision 48 a iv (2)), that mercury monitoring data reported shall not include hours of unit startup and shutdown which may serve to mitigate VCHEC's issue with higher than anticipated emissions for mercury during startup and shutdown.

Dominion's letter also asks that the calculations using a CO₂ "diluent cap" be retroactive to September 1, 2012. This request cannot be addressed under our authority to approve alternative test methods.

Based on our consideration of the background information provided by Dominion, we are approving the use of a CO₂ "diluent cap value" of 5.0 percent during periods of startup and shutdown for PM, SO₂, NO_x, and CO CEMS and reporting under Subpart Da. This approval is based on and limited by the following considerations:

- The 5.0 percent diluent cap value may only be applied during periods of startup and shutdown consistent with Dominion's statement that their higher than anticipated emissions occur during periods of startup and shutdown as defined in §60.2.
- Calculations using the diluent cap should be done on an hourly basis consistent with the approach in 40 CFR Parts 72 and 75.
- This alternative approval will be revisited at such time as new startup/shutdown provisions are promulgated for electric utility boilers (e.g., under 40 CFR 60, Subpart Da and/or 40 CFR Part 63, Subpart UUUUU – National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-fired Electric Utility Steam Generating Units) or the availability of empirical data under startup/shutdown conditions allows for refinement of this decision.
- As noted previously, our authority and consequently, this approval, is limited to the monitoring and reporting required under Subpart Da. A separate decision will need to be issued by the appropriate delegated authority as to the applicability of this approach to the PM, SO₂, NO_x, and CO monitoring/reporting required under VCHEC's Prevention of Significant Deterioration and Case-By-Case MACT Permits.

If you have any questions regarding this alternative method approval, you may contact Robin Segall of my staff at (919)541-0893 or segall.robina@epa.gov.

cc: Kellie Ortega, OECA
Christian Fellner, OAQPS/SPPD
Bill Maxwell, OAQPS/SPPD
Barrett Parker, OAQPS/SPPD

From: Garnett, Kim [<mailto:Garnett.Kim@epa.gov>]

Sent: Monday, November 10, 2014 1:26 PM

To: Wesley A Ball (Services - 6)

Cc: Segall, Robin; Dewees, Jason; hagedorn, james

Subject: Dominion Diluent Cap Request

Alan,

I wanted to follow up our conversation with an email. As we discussed, since the alternative method request for the diluent cap at Hopewell, Southampton and Altavista involves the BACT limits and not the limits in 40 CFR 60, Subpart Db, the Measurement Technology Group does not have the authority to grant an alternative in this situation. I have discussed your request with Jim Hagedorn in Region 3 and he says the authority for granting an alternative test method for the BACT limits has been delegated to the State of Virginia as the compliance/enforcement authority.

If there is any way that we can be of assistance to the State of Virginia during this process please let us know.

Thanks,

Kim

Kim Garnett

Engineer

USEPA/OAQPS/MTG (E143-02)

109 TW Alexander Drive

Research Triangle Park, NC 27711

TEL-(919)541-1158/FAX-(919)541-0516

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one common monitoring system are to be summed when electrical output-based emission rate calculations are made.

Section 1.2.5 of the RTC contains both a summary of comments received on this topic and the EPA's response to those comments.

5. Diluent Cap

Apart from allowing use of a diluent cap when calculating Hg emissions during startup periods or shutdown periods, the final rule contained no allowance for use of a diluent cap. The November 2012 proposal sought comment on the need for a diluent cap for other HAP emissions during startup periods and shutdown periods. Use of a diluent cap can be important during startup periods and shutdown periods because CEMS values can approach infinity because the denominator in the calculations for CEMS values can approach zero during those periods. Moreover, use of a diluent cap becomes a common stack issue when one or more of the EGUs is in a startup or shutdown mode and just one monitoring instrument is used in the stack.

The EPA considered each comment and decided to allow use of default carbon dioxide (CO₂) or oxygen (O₂) values as identified in Section 3.3.4.1 of Appendix F of 40 CFR part 75, but only for startup periods or shutdown periods when CO₂ values are below or O₂ values are above default values for use in all pollutant calculations. For non-IGCC EGUs, the default CO₂ value is 5 percent and the default O₂ value is 14 percent. This means that when CEMS CO₂ measurements are below 5 percent, EGU owners or operators are allowed to use 5 percent CO₂ in their calculations. Because the startup analysis showed that CEMS CO₂ measurements exceeded default values within 2 hours of generation, the EPA does not expect to find default values being used when startup periods end. Likewise, when CEMS O₂ measurements are larger than 14 percent, EGU owners or operators will be able to use 14-percent O₂ in their calculations. IGCC EGUs will be allowed to use 1 percent as a default CO₂ value or 19 percent as a default O₂ value. As mentioned earlier, default diluent gas values will be allowed for use in calculations for startup periods or shutdown periods when CO₂ CEMS values are below or O₂ CEMS values are above default values. The rule requires EGU owners or operators to use actual CO₂ or O₂ CEMS values for all other operating periods. Although the EPA has no specific data or information concerning emissions during transient events outside startup or shutdown

periods, the EPA expects the short duration of these transient events outside startup or shutdown periods that could cause CO₂ or O₂ CEMS to be below (or above) default values to have little, if any, impact on the 30-boiler operating day rolling averages.

The rule retains the requirement for EGU owners or operators to report instrumental CEMS, PM CPMS, and sorbent trap information, as well as flow rate information during startup periods or shutdown periods. Such information may prove useful in assessing potential emissions or operational limits in future rulemaking activities. Finally, the rule requires EGU owners or operators to identify each hour of startup or shutdown in which a diluent cap value is used.

Section 5.1 of the RTC contains both a summary of comments received on this topic and the EPA's response.

6. Default Electrical Output

The final rule provided no allowance regarding default electrical output. The November 2012 proposal sought comment on the need for a default electrical output for those owners or operators who choose to comply with a mass per electrical output standard. Use of a default electrical output cap can be important during startup periods and shutdown periods because the calculated mass per electrical output values can approach infinity when the electrical output is zero during those periods.

Upon consideration of the comments, the rule will provide a default electrical load value that EGU owners or operators will be allowed to use during startup periods or shutdown periods to calculate emissions rates for an EGU, as long as the electrical load for the EGU is zero. Once the EGU begins generating electricity, the source must use the actual electrical output in compliance calculations, even if the output is below the 5 percent default value. Moreover, use of a default electrical load is not allowed during periods other than startup or shutdown. As suggested by one commenter, the default electrical load will be equivalent to 5 percent of the maximum sustainable electrical output in megawatts of an EGU, as defined in section 6.5.2.1(a)(1) of appendix A to part 75, and included in an EGU's Part 75 electronic monitoring plan. This maximum sustainable load is either the nameplate capacity of the EGU or the highest electrical load observed in at least four representative quarters of EGU operation. When used in a common stack application, the default electrical load is 5 percent of the combined maximum sustainable

electrical load of the EGUs that are in startup or shutdown mode during an hour in which the electrical load is zero. The default electrical load is allowed to be used in electrical output-based emission rate calculations (either pounds per megawatt-hour (lb/MWh) or pounds per gigawatt-hour (lb/GWh)) for any hour in which the actual electrical load for a single EGU or for every EGU venting to a common stack is zero. The EPA considered, but decided against, requiring measurement of thermal heat output and conversion back into equivalent electrical output; instead, the EPA decided to use a simpler approach based on already-existing requirements of the Acid Rain Program that we believe are most appropriate considering CAA section 112 and in light of the available data. Finally, the rule requires EGU owners or operators to identify each hour of startup or shutdown in which a default electrical load value is used.

Section 5.2 of the RTC contains both a summary of comments received on this topic and the EPA's response to significant comments.

7. Use of Sorbent Traps

The final rule required continuous Hg data collection using sorbent traps or Hg CEMS under all process operating conditions, including, but not limited to, startup periods and shutdown periods, over the entire 30 boiler operating day LEE qualification testing period. For sorbent traps, the EPA allowed use of redundant backup sorbent trap monitoring systems during startup periods and shutdown periods; and required operation of sorbent trap monitoring systems and collection of Hg data at all times EGUs operate, but did not allow use of Hg data collected during startup or shutdown periods to be included in compliance calculations.

After consideration of comments received on Hg monitoring during startup or shutdown periods using sorbent trap monitoring systems, the EPA decided that the final reconsidered rule will contain three alternative approaches for measuring Hg emissions during startup periods or shutdown periods. In the first approach, EGU owners or operators will continue to be able to use Hg CEMS for measuring Hg emissions.

The second approach relies on at least two separate sorbent monitoring systems. Although the rule has no prohibition against an EGU owner or operator using one sorbent trap monitoring system for compliance purposes during periods other than startup or shutdown and one (or more) sorbent trap monitoring systems for