



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
RESEARCH TRIANGLE PARK, NC 27711

MAR 02 2016

OFFICE OF  
AIR QUALITY PLANNING  
AND STANDARDS

Mr. David Craymer  
Vice President – Power Generation System Operations  
Dominion Virginia Power  
5000 Dominion Boulevard  
Glen Allen, Virginia 23060

Dear Mr. Craymer:

I am writing in response to your letter dated February 1, 2016, in which you request an alternative test method for the boilers belonging to Dominion located at the Altavista, Hopewell and Southampton Power Stations. These boilers are subject to the National Emissions Standards found at 40 CFR part 63, Subpart DDDDD, National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters (Boiler MACT). Additionally, on March 11, 2015, we approved, as an alternative test method, the use of dilution extractive wet basis monitoring systems, already installed, to continuously measure stack carbon dioxide (CO<sub>2</sub>) in lieu of oxygen (O<sub>2</sub>) concentrations in conjunction with the carbon monoxide (CO) monitoring being conducted at the Altavista, Hopewell and Southampton Power Stations.

According to the information you provided, the boilers at Altavista, Hopewell and Southampton Power Stations are subject to 40 CFR 63.7525(a)(2)(vi), which states:

“When CO<sub>2</sub> is used to correct CO emissions and CO<sub>2</sub> is measured on a wet basis, correct for moisture as follows: Install, operate, maintain, and quality assure a continuous moisture monitoring system for measuring and recording the moisture content of the flue gases, in order to correct the measured hourly volumetric flow rates for moisture when calculating CO concentrations.”

The above language requires facilities that use CO<sub>2</sub>, measured on a wet basis to correct their CO emissions, to install a continuous moisture monitoring system. However, you request permission to use the methodology detailed in an attachment to this letter which employs the equations in 40 CFR part 60, Appendix A, Method 19, to continuously calculate emissions of

CO corrected to 3 percent O<sub>2</sub> on a dry basis, instead of installing a continuous moisture monitoring system as described above.

After reviewing the information provided, we approve your request to use the methodology which employs the equations in Method 19 to continuously calculate your emissions of CO corrected to 3 percent O<sub>2</sub> on dry basis in lieu of the continuous moisture monitoring system required by 40 CFR 63.7525(a)(2)(vi), using the detailed methodology in the attachment. However, as you indicate in your request, this alternative methodology may only be used when the CO and CO<sub>2</sub> are both being measured on a wet basis.

Since this alternative method could be applicable to other similar facilities subject to the requirement found in 40 CFR 63.7525(a)(2)(vi), we will post this letter on our website at <http://www.epa.gov/ttn/emc/approalt.html> so that after the date of this letter other interested parties may make use of this alternative method. However, please note that this alternative method only applies to the requirement for a moisture monitor as specified in 40 CFR 63.7525(a)(2)(vi), and should not be construed as allowing the use of a CO<sub>2</sub> monitor in place of an O<sub>2</sub> monitor to determine the compliance on a continuous basis with the CO emission concentration standard (as corrected to three percent oxygen). Facilities that would like to use a CO<sub>2</sub> monitor in place of an O<sub>2</sub> monitor must first request permission through the alternative test method process.

If you have any questions regarding this determination, please contact Ms. Kim Garnett of my staff at 919-541-1158 or [garnett.kim@epa.gov](mailto:garnett.kim@epa.gov).

Sincerely,



Steffan M. Johnson, Leader  
Measurement Technology Group

Attachment

cc: Todd Alonzo, VDEQ ([todd.alonzo@deq.virginia.gov](mailto:todd.alonzo@deq.virginia.gov))  
Jim Eddinger, EPA/OAQPS/SPPD ([edding.jim@epa.gov](mailto:edding.jim@epa.gov))  
Diana Esher, EPA Region III ([esher.diana@epa.gov](mailto:esher.diana@epa.gov))  
Kim Garnett, EPA/OAQPS/AQAD ([garnett.kim@epa.gov](mailto:garnett.kim@epa.gov))  
Dave Nuckols, Dominion ([david.nuckols@dom.com](mailto:david.nuckols@dom.com))

## Attachment

### DEVELOPING AN ALTERNATIVE APPROACH

Our recommended, alternative approach is rooted in the equations contained in EPA Method 19.<sup>4</sup> Presented below is Equation 19-1, which is the equation of choice for calculating a pollutant emission rate from a dry-based pollutant concentration and a dry-based O<sub>2</sub> measurement.

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

Where:

- E = pollutant emission rate, lb/10<sup>6</sup> Btu
- C<sub>d</sub> = pollutant concentration, dry basis, lb/dscf<sup>5</sup>
- O<sub>2d</sub> = oxygen concentration, dry basis, percent
- F<sub>d</sub> = volume of combustion gases per unit of heat input, scf/10<sup>6</sup> Btu

Next, we provide Equation 19-7, which is the equation of choice for calculating a pollutant emission rate from a wet-based pollutant concentration and a wet-based CO<sub>2</sub> measurement.

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

Where:

- E = pollutant emission rate, lb/10<sup>6</sup> Btu
- C<sub>w</sub> = pollutant concentration, wet basis, lb/dscf
- CO<sub>2w</sub> = carbon dioxide concentration, wet basis, percent
- F<sub>c</sub> = volume of carbon dioxide gases per unit of heat input, scf/10<sup>6</sup> Btu

The two expressions can be set equal to one another since they are both equal to the same quantity, E or pollutant emission rate expressed in pounds of pollutant per million Btu heat input (lb/10<sup>6</sup> Btu). (It is worth noting that the unit, lb/10<sup>6</sup> Btu heat input, is independent of moisture basis.)

$$C_d \times F_d \times \frac{20.9}{(20.9 - \%O_{2d})} = C_w \times F_c \times \frac{100}{\%CO_{2w}}$$

Rearranging and solving for C<sub>d</sub> yields:

$$C_d = C_w \times \frac{F_c}{F_d} \times \frac{100}{\%CO_{2w}} \times \frac{(20.9 - \%O_{2d})}{20.9}$$

Now, converting C to the ppm pollutant of interest by the conversion factor K (C<sub>lb/dscf</sub> = CO<sub>ppm</sub> × K<sub>CO</sub> similar to Table 19-1, Method 19) and setting the O<sub>2d</sub> level to the 3 percent value specified in the rule will yield the desired CO ppm dry basis at 3%O<sub>2</sub>. The K factor cancels and simplifying the formula yields:

$$CO_d = 85.6 \times CO_w \times \frac{F_c}{F_d} \times \frac{1}{\%CO_{2w}}$$

Where:

$CO_d$  = carbon monoxide concentration, dry basis ppm @ 3%O<sub>2</sub>

$CO_w$  = carbon monoxide concentration (measured), wet basis ppm

$CO_{2w}$  = carbon dioxide concentration, wet basis, percent

$F_c$  = volume of carbon dioxide gases per unit of heat input, scf/10<sup>6</sup> Btu

$F_d$  = volume of combustion gases per unit of heat input, scf/10<sup>6</sup> Btu

Thus, using two basic equations in EPA Method 19, we have demonstrated that CO concentration on a dry basis corrected to 3 percent O<sub>2</sub> can be calculated directly from a wet-based CO concentration and wet-based CO<sub>2</sub> concentration measurements. Using the above equation with the CO<sub>w</sub> measurement made in ppm(v) units, provides the calculated CO<sub>c</sub> concentration in ppm(v) units.