

Southwest Clean Air Agency

Guidance for Selecting Calibration Gases for Combustion Monitoring

To be prepared for combustion monitoring at the vast majority of the combustion sources in SWCAA's jurisdiction, owners of boilers or heaters or companies performing combustion monitoring activities should target the following two EPA Protocol calibration gases to minimize the need for additional calibration gases:

Calibration Gas Cylinder #1: 18 ppm NO_x, 50 ppm CO, balance N₂

Calibration Gas Cylinder #2: 70 ppm NO_x, 200 ppm CO, balance N₂

Background

Many sources of air pollution in SWCAA's jurisdiction are required to perform periodic (usually annual) combustion monitoring. For combustion sources such as boilers and heaters, this usually consists of measuring the carbon monoxide (CO), nitrogen oxides (NO_x), and oxygen (O₂) concentration in the exhaust gas of the unit while in a high firing condition. To conduct this combustion monitoring properly, a combustion analyzer "response check" must be conducted before and after the combustion monitoring event.

The response check is a procedure whereby a calibration gas is used to check the analyzer for drift and scale the measured pollution concentrations appropriately. Unless otherwise specified in the individual Air Discharge Permit, the calibration gases used in this procedure must be no less than 50 percent, and no more than 200 percent, of the emission concentration corresponding to the permitted emission limit. When actual emission concentrations are significantly less than the permitted emission limit, a lower concentration calibration gas may be used if it is more representative of the measured concentrations. Ambient air may be used to zero CO and NO_x cells/analyzer(s) and span oxygen cells/analyzer.

Note Regarding Response Checks

It is not necessary to adjust the analyzer response to match the value of the calibration gas. SWCAA's Combustion Monitoring Worksheet should be used to scale the analyzer responses appropriately based on the results of the response checks. For example, if a CO cell/analyzer zeros perfectly and reads a 50 ppm CO calibration gas as 54 ppm before and after a combustion monitoring event, the spreadsheet will scale all monitored CO values by 8% (the ratio of 54 to 50) to correct for the analyzer bias.

In lieu of the combustion monitoring (tune-up) form attached to Air Discharge Permits, SWCAA prefers that sources and combustion monitoring companies use an Excel based worksheet to assist with the reporting of combustion monitoring results. The worksheet helps with the calculations and corrections in reporting exhaust gas concentrations correctly. SWCAA's combustion monitoring worksheet is available at: <http://www.swcleanair.gov/forms/misc.asp>.

Calibration Gas Specifications

NO_x, CO and CO₂ calibration gases must be certified by the supplier to meet EPA Protocol gas specifications. EPA Protocol quality gas is called out for this monitoring, however, any calibration gas that is certified to meet ±2 % of the referenced concentration is acceptable. The purchase of O₂ calibration gases is not required. Ambient air (20.95% O₂) may be used to check the zero of CO, NO_x, and CO₂ cells/analyzer(s) and span the oxygen cells/analyzer. The remainder (balance) of the gas in a calibration gas cylinder may be air or nitrogen (N₂). Nitrogen is preferred. If the balance of the calibration gas cylinder is N₂, the calibration gas may also be used to zero the oxygen cell/analyzer.

Calibration Gas Ranges

As indicated in the tables below, the vast majority of the combustion monitoring required within SWCAA's jurisdiction (Clark, Cowlitz, Lewis, Skamania, and Wahkiakum Counties) can be accomplished with two concentrations of NO_x calibration gases, and two concentrations of CO calibration gases. NO_x and CO calibration gases can be blended into a single cylinder, bringing the total number of cylinders necessary to conduct most combustion monitoring to two (one in each range). A third concentration may be necessary if performing combustion monitoring for biomass burners or asphalt plants due to higher levels of permitted emission concentrations.

NO_x Calibration Gases

Permitted Range	Acceptable Calibration Gas for this Range	Notes
9 – 35 ppm	18 ppm	Range of most newer natural gas fired units. Very few units required to meet lower limits.
35 – 140 ppm	70 ppm	Range of most diesel units and older natural gas fired units.
140 – 560 ppm	280 ppm	Seldom encountered. May be encountered at older biomass burners or asphalt plants.

CO Calibration Gases

Permitted Range	Acceptable Calibration Gas for this Range	Notes
30 - 100 ppm	50 ppm	Range of most natural gas and diesel fired units. Very few units required to meet lower limits.
100 - 400 ppm	200 ppm	Encountered with older gas units, biomass, asphalt plants.
400 – 1,600 ppm	800 ppm	Seldom encountered.

To be prepared for combustion monitoring at the vast majority of the combustion sources in SWCAA's jurisdiction, owners of boilers and/or heaters and companies performing combustion monitoring should have the following two EPA Protocol calibration gases:

Calibration Gas Cylinder #1: 18 ppm NO_x, 50 ppm CO, balance N₂

Calibration Gas Cylinder #2: 70 ppm NO_x, 200 ppm CO, balance N₂

CO₂-Based Analyzers: 10% CO₂ (not required for analyzers with an O₂ cell. May be blended with other calibration gases)

Additional Notes

- Much of the cost of purchasing calibration gas cylinders is the cost of analysis by the calibration gas supplier; therefore, purchasing larger cylinders may be more cost-effective in the long run than purchasing multiple smaller cylinders.
- Calibration gases are certified to be valid for a fixed period of time. Calibration gases that are past their certification expiration date will invalidate the results and cannot be used for combustion monitoring.
- If you are unsure what emission limits or oxygen correction apply to a combustion unit, contact SWCAA or visit SWCAA's website (www.swcleanair.gov) for a copy of the relevant permit or rule. All permits are available online.
- Unless otherwise specified in a permit or rule, NO_x and CO results should be corrected to the following:
 - 3% for natural gas, propane, and diesel fired boilers
 - 7% for wood fired boilers
 - 15% for asphalt plants
- Do not report combustion monitoring results that have been automatically corrected by the analyzer (e.g. to 3% O₂). The raw, uncorrected NO_x and CO values must be entered into the combustion monitoring worksheet to ensure that the proper corrections are made for analyzer drift, bias and O₂ concentration correction.
- Combustion analyzer report strips/tapes (or analyzer printouts) are required to be submitted with the combustion monitoring worksheet.
- Calibration gas certificates or photos of the certifications on the individual gas bottles are required to be submitted with the combustion monitoring worksheet.

If you have any questions, please contact SWCAA at 360-574-3058.