Specifications and Requirements for Portable Gas Analyzers

If acceptable by permit, exhaust emissions may be determined using Portable Gas Analyzers which meet the following specifications and requirements:

Specifications:

The analyzer must meet the measurement system performance specifications of ASTM D6522. A brief summary of the specifications are as follows:

Zero Calibration Error:	Less than or equal to $\pm$ 3% of the span gas value for pollutant gases and less than or equal to $\pm$ 0.3% for oxygen concentration.
Span Calibration Error:	Less than or equal to $\pm$ 5% of the span gas value for pollutant gases and less than or equal to $\pm$ 0.5% for oxygen concentration.
Interference Response:	Less than or equal to $\pm$ 5% of the measured stack concentration.
Resolution:	NO and NO_2 - 1 PPM, O_2 - 0.1%.

The calibration of the analyzer may be done by the manufacturer and shall be done on their recommended schedule, usually annually. A signed copy of the most recent calibration certification sheet shall be included in the test report.

Requirements:

Measurement system performance verifications shall be completed at the test location and documented in the test report. Gases used for calibration verifications shall be certified according to standard EPA protocols and be in an appropriate range to bracket the stack concentration of each pollutant measured.

The verification of the analyzer should demonstrate linearity across three points (high, medium, and zero range).

A minimum of one hour (sixty one-minute readings) of pollutant measurements shall constitute a test.

Verification of absence of stack gas stratification shall be conducted.

To verify the appropriateness of portable analyzer test procedures, a pre-test protocol should be submitted to the Department for approval prior to testing.

Pollutant emissions shall be reported in all units required by permit, but at a minimum, shall include parts per million by volume (dry basis) and lbs/hr.

The volumetric flow rate may also be determined by either EPA Methods 1-4 or Method 19 "F-factor". The "F-factor" is calculated based on the specific gas analysis, which relates exhaust gas flow to heat or energy input via the specific fuel. Fuel consumption and volumetric emissions levels are the main parameters involved in the calculation for mass emissions rates. The equation to determine mass emission rates using rated volumetric flow rate and sample calculation to determine mass emission rate using EPA's Method 19 "F-factor" is shown in Appendix A.

Appendix A

A. Mass Basis Emission Calculations using volumetric flow rate:

The mass emission rate can be calculated using the following equation:

$$\text{lb/hr} = \frac{\text{PPM} * \text{MW} * \text{dscf/hr} * (10^{-6})\ \text{parts/million parts}}{385.3\,\text{dscf} / lb - mol}$$

B. Mass Basis Emission Calculations using EPA's Method "F-factor":

Fd (for natural gas) - Factor of 8710 dry standard cubic feet per 10^6 BTU as listed in Table 19-1 of EPA Method 19.

The emission rate can be calculated using the following equation:

Em: Cd * Fd * 20.9 / (20.9- %O2) * Qh * HHV

Where,

Em	=	Pollutant emission rate in lbs/hr
Cd	=	Pollutant concentration in lb/dscf
Fd	=	Average F-factor for Cd measurement on a dry basis, dscf per 10^6 BTU (8710 dscf per 10^6 BTU for natural gas)
$\%O_2$	=	Exhaust oxygen concentration in percent, measured on a dry basis
Qh*	=	Fuel rate in standard cubic feet per hour
HHV	=	Higher heating value of the fuel in BTU/SCF

* The fuel rate must be determined using a calibrated fuel flow monitor; calibration certification sheet must be included in test report.

The following conversion factor may be used to correct the pollutant concentration from PPM to lb/scf

To convert from	To Cd	Multiply By
PPM	lb/scf	pollutant molecular weight/385.3/10^6

Sample Calculation for Mass Basis Emission Calculations using EPA's Method 19 "F-factor":

Assuming 60 ppm @ 17.5% O_2, Fuel Rate - 250 scfm, HHV=1000 BTU/scf

$$\text{Em} = (60*46.01/385.3/10^6)\ \frac{lbs}{dscf} * \frac{8710}{10^6}\frac{dscf}{Btu} * \frac{20.9}{(20.9-17.5)} * 250\frac{scf}{\min} * 60\frac{\min}{hr} * 1000\frac{Btu}{scf}$$

= 5.65 lbs/hr

Horsepower Basis Emission Rate (gms/bhp-hr):

Assuming the engine was operating at 1450 BHP

Em in gms/bhp-hr = 5.65 lbs/hr * 454 gms/lb * 1/1450 bhp

= 1.77 gms/bhp-hr