12.0 What Calculations Are Needed for PS-1?

12.1 Desired Attenuator Values. Calculate the desired attenuator value corrected to the emission outlet pathlength as follows:

$$OP_2 = 1 - (1 - OP_1)^{\frac{L_2}{L_1}} \qquad Eq.\ 1\text{-}1$$

Where:
OP1 = Nominal opacity value of required low-, mid-, or high-range calibration attenuators.
OP2 = Desired attenuator opacity value from ASTM D 6216-98, section 7.5 at the opacity limit required by the applicable subpart.
L1 = Monitoring pathlength.
L2 = Emission outlet pathlength.

12.2 Luminous Transmittance Value of a Filter. Calculate the luminous transmittance of a filter as follows:

$$LT = \frac{\sum_{i=300_{nm}}^{i=800_{nm}} T_i}{100,000} \qquad Eq.\ 1\text{-}2$$

Where:
LT = Luminous transmittance
Ti = Weighted tested filter transmittance.

12.3 Arithmetic Mean. Calculate the arithmetic mean of a data set as follows:

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i \qquad Eq.\ 1\text{-}3$$

Where:

$\bar{x}$ = Arithmetic mean

n=Number of data points

$\sum_{i=1}^{n} x_i$ = Algebraic sum of the individual measurements, x_i.

12.4 Standard Deviation. Calculate the standard deviation as follows:

$$S_d = \sqrt{\frac{\sum_{i=1}^{n} x_i^2 - \frac{\left(\sum_{i=1}^{n} x_i\right)^2}{n}}{n-1}} \qquad Eq.\ 1\text{-}4$$

Where:

Sd = Standard deviation of a data set.

12.5 Confidence Coefficient. Calculate the 2.5 percent error confidence coefficient (one-tailed) as follows:

$$CC = \frac{t_{0.975} S_d}{\sqrt{n}} \qquad \text{Eq. 1-5}$$

Where:
CC = Confidence coefficient
t0.975 = t − value (see table 1-2).

12.6 Calibration Error. Calculate the error (calibration error, zero drift error, and calibration drift error) as follows:

$$Er = |\bar{x}| + |CC| \qquad \text{Eq. 1-6}$$

Where:
Er = Error.

12.7 Conversion of Opacity Values for Monitor Pathlength to Emission Outlet Pathlength. When the monitor pathlength is different from the emission outlet pathlength, use either of the following equations to convert from one basis to the other (this conversion may be automatically calculated by the monitoring system):

$$\log\ (1-Op_2) = \frac{L_2}{L_1} \log\ (1-Op_1) \qquad Eq.\ 1\text{-}7$$

$$OD_2 = \frac{L_2}{L_1} \times OD_1 \qquad Eq.\ 1\text{-}8$$

Where:
Op1 = Opacity of the effluent based upon L1.
Op2 = Opacity of the effluent based upon L2.
L1 = Monitor pathlength.
L2 = Emission outlet pathlength.
OD1 = Optical density of the effluent based upon L1.
OD2 = Optical density of the effluent based upon L2.

12.8 Mean Response Wavelength. Calculate the mean of the effective spectral response curve from the individual responses at the specified wavelength values as follows:

$$L = \frac{\sum_{i-1}^{n} L_i g_i}{\sum_{i-1}^{n} g_i} \qquad Eq.\ 1\text{-}9$$

Where:
L = mean of the effective spectral response curve

L_i = The specified wavelength at which the response g_i is calculated at 20 nm intervals.
g_i = The individual response value at L_i.