$x_{\text{NMHCE}} = 145.6 - (100.8 \cdot 0.76 + 1.1 \cdot 0.74 + 19.1 \cdot 0.50 + 1.3 \cdot 0) + 100.8 + 1.1 + 19.1 + 1.3 - (1.07 \cdot 18.9)$

$x_{\text{NMHCE}} = 160.71 \ \mu\text{mol/mol}$

[73 FR 37337, June 30, 2008]

§ 1065.667 Dilution air background emission correction.

(a) To determine the mass of background emissions to subtract from a diluted exhaust sample, first determine the total flow of dilution air, n_{dil}, over the test interval. This may be a measured quantity or a quantity calculated from the diluted exhaust flow and the flow-weighted mean fraction of dilution air in diluted exhaust, $\bar{x}_{\text{dil/exh}}$. Multiply the total flow of dilution air by the mean concentration of a background emission. This may be a time-weighted mean or a flow-weighted mean (e.g., a proportionally sampled background). The product of n_{dil} and the mean concentration of a background emission is the total amount of a background emission. If this is a molar quantity, convert it to a mass by multiplying it by its molar mass, M. The result is the mass of the background emission, m. In the case of PM, where the mean PM concentration is already in units of mass per mole of sample, $\bar{M}_{\text{PM}}$, multiply it by the total amount of dilution air, and the result is the total background mass of PM, m_{PM}. Subtract total background masses from total mass to correct for background emissions.

(b) You may determine the total flow of dilution air by a direct flow measurement. In this case, calculate the total mass of background as described in § 1065.650(c), using the dilution air flow, n_{dil}. Subtract the background mass from the total mass. Use the result in brake-specific emission calculations.

(c) You may determine the total flow of dilution air from the total flow of diluted exhaust and a chemical balance of the fuel, intake air, and exhaust as described in § 1065.655. In this case, calculate the total mass of background as described in § 1065.650(c), using the total flow of diluted exhaust, n_{dexh}, then multiply this result by the flow-weighted mean fraction of dilution air in diluted exhaust, $\bar{x}_{\text{dil/exh}}$. Calculate $\bar{x}_{\text{dil/exh}}$ using flow-weighted mean concentrations of emissions in the chemical balance, as described in § 1065.655. You may assume that your engine operates stoichiometrically, even if it is a lean-burn engine, such as a compression-ignition engine. Note that for lean-burn engines this assumption could result in an error in emission calculations. This error could occur because the chemical balances in § 1065.655 correct excess air passing through a lean-burn engine as if it was dilution air. If an emission concentration expected at the standard is about 100 times its dilution air background concentration, this error is negligible. However, if an emission concentration expected at the standard is similar to its background concentration, this error could be significant. If this error might affect your ability to show that your engines comply with applicable standards, we recommend that you remove background emissions from dilution air by HEPA filtration, chemical adsorption, or catalytic scrubbing. You might also consider using a partial-flow dilution technique such as a bag mini-diluter, which uses purified air as the dilution air.

(d) The following is an example of using the flow-weighted mean fraction of dilution air in diluted exhaust, $\bar{x}_{\text{dil/exh}}$, and the total mass of background emissions calculated using the total flow of diluted exhaust, n_{dexh}, as described in § 1065.650(c):

$$m_{\text{bkgnd}} = \bar{x}_{\text{dil/exh}} \cdot m_{\text{bkgnddexh}} \qquad \text{Eq. 1065.667-1}$$

$$m_{\text{bkgnddexh}} = M \cdot \bar{x}_{\text{bkgnd}} \cdot n_{\text{dexh}} \qquad \text{Eq. 1065.667-2}$$

Example:

$M_{\text{NOx}} = 46.0055$ g/mol

$\bar{x}_{\text{bkgnd}} = 0.05 \ \mu\text{mol/mol} = 0.05 \cdot 10^{-6}$ mol/mol

$n_{\text{dexh}} = 23280.5$ mol

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$\bar{x}_{\text{dil/exh}}$ = 0.843 mol/mol
$m_{\text{bkgndNOxdexh}}$ = 46.0055·0.05·10^{-6}·23280.5
$m_{\text{bkgndNOxdexh}}$ = 0.0536 g
m_{bkgndNOx} = 0.843 · 0.0536
m_{bkgndNOx} = 0.0452 g

(e) The following is an example of using the fraction of dilution air in diluted exhaust, $x_{\text{dil/exh}}$, and the mass rate of background emissions calculated using the flow rate of diluted exhaust, $\dot{n}_{\text{dexh}}$, as described in §1065.650(c):

$$\dot{m}_{\text{bkgnd}} = x_{\text{dil/exh}} \cdot \dot{m}_{\text{bkgnddexh}} \qquad \text{Eq. 1065.667-3}$$

$$\dot{m}_{\text{bkgnddexh}} = M \cdot x_{\text{bkgnd}} \cdot \dot{n}_{\text{dexh}} \qquad \text{Eq. 1065.667-4}$$

Example:
M_{NOx} = 46.0055 g/mol
x_{bkgnd} = 0.05 μmol/mol = 0.05·10^{-6} mol/mol
$\dot{n}_{\text{dexh}}$ = 23280.5 mol/s
$x_{\text{dil/exh}}$ = 0.843 mol/mol
$\dot{m}_{\text{bkgndNOxdexh}}$ = 36.0055·0.05·10^{-6} · 23280.5
$\dot{m}_{\text{bkgndNOxdexh}}$ = 0.0536 g/hr
$\dot{m}_{\text{bkgndNOx}}$ = 0.843 · 0.0536
$\dot{m}_{\text{bkgndNOx}}$ = 0.0452 g/hr

[73 FR 59339, Oct. 8, 2008, as amended at 75 FR 23055, Apr. 30, 2010]

§ 1065.670 NO$_X$ intake-air humidity and temperature corrections.

See the standard-setting part to determine if you may correct NO$_X$ emissions for the effects of intake-air humidity or temperature. Use the NO$_X$ intake-air humidity and temperature corrections specified in the standard-setting part instead of the NO$_X$ intake-air humidity correction specified in this part 1065. If the standard-setting part does not prohibit correcting NO$_X$ emissions for intake-air humidity according to this part 1065, first apply any NO$_X$ corrections for background emissions and water removal from the exhaust sample, then correct NO$_X$ concentrations for intake-air humidity. You may use a time-weighted mean combustion air humidity to calculate this correction if your combustion air humidity remains within a tolerance of ±0.0025 mol/mol of the mean value over the test interval. For intake-air humidity correction, use one of the following approaches:

(a) For compression-ignition engines, correct for intake-air humidity using the following equation:

$$x_{\text{NOxcor}} = x_{\text{NOxuncor}} \cdot \left(9.953 \cdot x_{\text{H20}} + 0.832\right) \qquad \text{Eq. 1065.670-1}$$

Example:
x_{NOxuncor} = 700.5 μmol/mol
x_{H2O} = 0.022 mol/mol
x_{NOxcor} = 700.5 · (9.953 · 0.022 + 0.832)
x_{NOxcor} = 736.2 μmol/mol

(b) For spark-ignition engines, correct for intake-air humidity using the following equation:

$$x_{\text{NOxcor}} = x_{\text{NOxuncor}} \cdot \left(18.840 \cdot x_{\text{H20}} + 0.68094\right) \qquad \text{Eq. 1065.670-2}$$

Example:
x_{NOxuncor} = 154.7 μmol/mol
x_{H2O} = 0.022 mol/mol
x_{NOxcor} = 154.7 · (18.840 · 0.022 + 0.68094)
x_{NOxcor} = 169.5 μmol/mol

(c) Develop your own correction, based on good engineering judgment.

[75 FR 23056, Apr. 30, 2010]