

§ 1065.670

40 CFR Ch. I (7-1-11 Edition)

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, $\bar{x}_{dil/exh}$, and the total mass of background emissions calculated using the total flow of diluted exhaust, n_{dexh} , as described in § 1065.650(c):

$$m_{bknd} = \bar{x}_{dil/exh} \cdot m_{bknddexh} \quad \text{Eq. 1065.667-1}$$

$$m_{bknddexh} = M \cdot \bar{x}_{bknd} \cdot n_{dexh} \quad \text{Eq. 1065.667-2}$$

Example:

$M_{NOx} = 46.0055 \text{ g/mol}$
 $\bar{x}_{bknd} = 0.05 \text{ } \mu\text{mol/mol} = 0.05 \cdot 10^{-6} \text{ mol/mol}$
 $n_{dexh} = 23280.5 \text{ mol}$
 $\bar{x}_{dil/exh} = 0.843 \text{ mol/mol}$
 $m_{bkndNOxdexh} = 46.0055 \cdot 0.05 \cdot 10^{-6} \cdot 23280.5$
 $m_{bkndNOxdexh} = 0.0536 \text{ g}$
 $m_{bkndNOx} = 0.843 \cdot 0.0536$

$m_{bkndNOx} = 0.0452 \text{ g}$

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

$$\dot{m}_{bknd} = x_{dil/exh} \cdot \dot{m}_{bknddexh} \quad \text{Eq. 1065.667-3}$$

$$\dot{m}_{bknddexh} = M \cdot x_{bknd} \cdot \dot{n}_{dexh} \quad \text{Eq. 1065.667-4}$$

Example:

$M_{NOx} = 46.0055 \text{ g/mol}$
 $x_{bknd} = 0.05 \text{ } \mu\text{mol/mol} = 0.05 \cdot 10^{-6} \text{ mol/mol}$
 $\dot{n}_{dexh} = 23280.5 \text{ mol/s}$
 $x_{dil/exh} = 0.843 \text{ mol/mol}$
 $\dot{m}_{bkndNOxdexh} = 36.0055 \cdot 0.05 \cdot 10^{-6} \cdot 23280.5$
 $\dot{m}_{bkndNOxdexh} = 0.0536 \text{ g/hr}$
 $\dot{m}_{bkndNOx} = 0.843 \cdot 0.0536$
 $\dot{m}_{bkndNOx} = 0.0452 \text{ g/hr}$

[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 $\pm 0.0025 \text{ mol/mol}$ 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:

$$x_{\text{NOxcor}} = x_{\text{NOxuncor}} \cdot (9.953 \cdot x_{\text{H}_2\text{O}} + 0.832) \quad \text{Eq. 1065.670-1}$$

Example:

$x_{\text{NOxuncor}} = 700.5 \mu\text{mol/mol}$
 $x_{\text{H}_2\text{O}} = 0.022 \text{ mol/mol}$
 $x_{\text{NOxcor}} = 700.5 \cdot (9.953 \cdot 0.022 + 0.832)$

$x_{\text{NOxcor}} = 736.2 \mu\text{mol/mol}$

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

$$x_{\text{NOxcor}} = x_{\text{NOxuncor}} \cdot (18.840 \cdot x_{\text{H}_2\text{O}} + 0.68094) \quad \text{Eq. 1065.670-2}$$

Example:

$x_{\text{NOxuncor}} = 154.7 \mu\text{mol/mol}$
 $x_{\text{H}_2\text{O}} = 0.022 \text{ mol/mol}$
 $x_{\text{NOxcor}} = 154.7 \cdot (18.840 \cdot 0.022 + 0.68094)$
 $x_{\text{NOxcor}} = 169.5 \mu\text{mol/mol}$

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

[75 FR 23056, Apr. 30, 2010]

§ 1065.672 Drift correction.

(a) *Scope and frequency.* Perform the calculations in this section to determine if gas analyzer drift invalidates the results of a test interval. If drift does not invalidate the results of a test interval, correct that test interval's gas analyzer responses for drift according to this section. Use the drift-corrected gas analyzer responses in all subsequent emission calculations. Note that the acceptable threshold for gas analyzer drift over a test interval is specified in §1065.550 for both laboratory testing and field testing.

(b) *Correction principles.* The calculations in this section utilize a gas analyzer's responses to reference zero and span concentrations of analytical gases, as determined sometime before

and after a test interval. The calculations correct the gas analyzer's responses that were recorded during a test interval. The correction is based on an analyzer's mean responses to reference zero and span gases, and it is based on the reference concentrations of the zero and span gases themselves. Validate and correct for drift as follows:

(c) *Drift validation.* After applying all the other corrections—except drift correction—to all the gas analyzer signals, calculate brake-specific emissions according to §1065.650. Then correct all gas analyzer signals for drift according to this section. Recalculate brake-specific emissions using all of the drift-corrected gas analyzer signals. Validate and report the brake-specific emission results before and after drift correction according to §1065.550.

(d) *Drift correction.* Correct all gas analyzer signals as follows:

(1) Correct each recorded concentration, x_i , for continuous sampling or for batch sampling, \bar{x} .

(2) Correct for drift using the following equation:

$$x_{\text{idriftcorrected}} = x_{\text{refzero}} + (x_{\text{refspan}} - x_{\text{refzero}}) \cdot \frac{2x_i - (x_{\text{prezero}} + x_{\text{postzero}})}{(x_{\text{prespan}} + x_{\text{postspan}}) - (x_{\text{prezero}} + x_{\text{postzero}})}$$

Eq. 1065.672-1

Where:

$x_{\text{idriftcorrected}}$ = concentration corrected for drift.

x_{refzero} = reference concentration of the zero gas, which is usually zero unless known to be otherwise.