

§ 1065.660

40 CFR Ch. I (7–1–10 Edition)

(3) You may also use a nominal value of absolute pressure based on an alarm set point, a pressure regulator set point, or good engineering judgment.

(4) Set $x_{\text{H}_2\text{O}[\text{emission}]_{\text{meas}}}$ equal to that of the measured upstream humidity condition if it is lower than the dryer saturation conditions.

(c) For a corresponding concentration or flow measurement where you did not remove water, you may determine the amount of initial water by any of the following:

(1) Use any of the techniques described in paragraph (b) of this section.

(2) If the measurement comes from raw exhaust, you may determine the amount of water based on intake-air humidity, plus a chemical balance of fuel, intake air and exhaust as described in §1065.655.

(3) If the measurement comes from diluted exhaust, you may determine the amount of water based on intake-air humidity, dilution air humidity, and a chemical balance of fuel, intake air, and exhaust as described in §1065.655.

(d) Perform a removed water correction to the concentration measurement using the following equation:

$$x = x_{[\text{emission}]_{\text{meas}}} \cdot \left[\frac{1 - x_{\text{H}_2\text{Oexh}}}{1 - x_{\text{H}_2\text{O}[\text{emission}]_{\text{meas}}}} \right] \quad \text{Eq. 1065.659-1}$$

Example:

$x_{\text{CO}_{\text{meas}}} = 29.0 \mu\text{mol/mol}$
 $x_{\text{H}_2\text{O}_{\text{CO}_{\text{meas}}}} = 8.601 \text{ mmol/mol} = 0.008601 \text{ mol/mol}$
 $x_{\text{H}_2\text{Oexh}} = 34.04 \text{ mmol/mol} = 0.03404 \text{ mol/mol}$

$$x_{\text{CO}} = 29.0 \cdot \left[\frac{1 - 0.03404}{1 - 0.008601} \right]$$

$x_{\text{CO}} = 28.3 \mu\text{mol/mol}$
 [73 FR 37335, June 30, 2008]

§ 1065.660 **THC and NMHC determination.**

(a) *THC determination and THC/CH₄ initial contamination corrections.* (1) If we require you to determine THC emissions, calculate $x_{\text{THC}[\text{THC-FID}]_{\text{cor}}}$ using the initial THC contamination concentration $x_{\text{THC}[\text{THC-FID}]_{\text{init}}}$ from §1065.520 as follows:

$$x_{\text{THC}[\text{THC-FID}]_{\text{cor}}} = x_{\text{THC}[\text{THC-FID}]_{\text{uncor}}} - x_{\text{THC}[\text{THC-FID}]_{\text{init}}} \quad \text{Eq. 1065.660-1}$$

Example:

$x_{\text{THC}_{\text{uncor}}} = 150.3 \mu\text{mol/mol}$
 $x_{\text{THC}_{\text{init}}} = 1.1 \mu\text{mol/mol}$
 $x_{\text{THC}_{\text{cor}}} = 150.3 - 1.1$
 $x_{\text{THC}_{\text{cor}}} = 149.2 \mu\text{mol/mol}$

(2) For the NMHC determination described in paragraph (b) of this section, correct $x_{\text{THC}[\text{THC-FID}]}$ for initial HC contamination using Eq. 1065.660–1. You may correct $x_{\text{THC}[\text{NMHC-FID}]}$ for initial contamination of the CH₄ sample train using Eq. 1065.660–1, substituting in CH₄ concentrations for THC.

(3) For the CH₄ determination described in paragraph (c) of this section, you may correct $x_{\text{THC}[\text{NMHC-FID}]}$ for initial contamination of the CH₄ sample train

using Eq. 1065.660–1, substituting in CH₄ concentrations for THC.

(b) *NMHC determination.* Use one of the following to determine NMHC concentration, x_{NMHC} :

(1) If you do not measure CH₄, you may determine NMHC concentrations as described in §1065.650(c)(1)(vi).

(2) For nonmethane cutters, calculate x_{NMHC} using the nonmethane cutter's penetration fractions (PF) of CH₄ and C₂H₆ from §1065.365, and using the HC contamination and dry-to-wet corrected THC concentration $x_{\text{THC}[\text{THC-FID}]_{\text{cor}}}$ as determined in paragraph (a) of this section.

Environmental Protection Agency

§ 1065.660

(i) Use the following equation for an NMC configuration as outlined in §1065.365(d):
penetration fractions determined using

$$x_{\text{NMHC}} = \frac{x_{\text{THC}[\text{THC-FID}]_{\text{cor}}} - x_{\text{THC}[\text{NMC-FID}]_{\text{cor}}} \cdot RF_{\text{CH}_4[\text{THC-FID}]}}{1 - RFPF_{\text{C}_2\text{H}_6[\text{NMC-FID}]} \cdot RF_{\text{CH}_4[\text{THC-FID}]}} \quad \text{Eq. 1065.660-2}$$

Where:

x_{NMHC} = concentration of NMHC.
 $x_{\text{THC}[\text{THC-FID}]_{\text{cor}}}$ = concentration of THC, HC contamination and dry-to-wet corrected, as measured by the THC FID during sampling while bypassing the NMC.
 $x_{\text{THC}[\text{NMC-FID}]_{\text{cor}}}$ = concentration of THC, HC contamination (optional) and dry-to-wet corrected, as measured by the NMC FID during sampling through the NMC.
 $RF_{\text{CH}_4[\text{THC-FID}]}$ = response factor of THC FID to CH_4 , according to §1065.360(d).
 $RFPF_{\text{C}_2\text{H}_6[\text{NMC-FID}]}$ = nonmethane cutter combined ethane response factor and penetration fraction, according to §1065.365(d).

Example:

$x_{\text{THC}[\text{THC-FID}]_{\text{cor}}} = 150.3 \mu\text{mol/mol}$
 $x_{\text{THC}[\text{NMC-FID}]_{\text{cor}}} = 20.5 \mu\text{mol/mol}$
 $RFPF_{\text{C}_2\text{H}_6[\text{NMC-FID}]} = 0.019$
 $RF_{\text{CH}_4[\text{THC-FID}]} = 1.05$

$$x_{\text{NMHC}} = \frac{150.3 - 20.5 \cdot 1.05}{1 - 0.019 \cdot 1.05}$$

$x_{\text{NMHC}} = 131.4 \mu\text{mol/mol}$

(ii) For penetration fractions determined using an NMC configuration as outlined in section §1065.365(e), use the following equation:

$$x_{\text{NMHC}} = \frac{x_{\text{THC}[\text{THC-FID}]_{\text{cor}}} \cdot PF_{\text{CH}_4[\text{NMC-FID}]_{\text{cor}}} - x_{\text{THC}[\text{NMC-FID}]}}{PF_{\text{CH}_4[\text{NMC-FID}]} - PF_{\text{C}_2\text{H}_6[\text{NMC-FID}]}} \quad \text{Eq. 1065.660-3}$$

Where:

x_{NMHC} = concentration of NMHC.
 $x_{\text{THC}[\text{THC-FID}]_{\text{cor}}}$ = concentration of THC, HC contamination and dry-to-wet corrected, as measured by the THC FID during sampling while bypassing the NMC.
 $PF_{\text{CH}_4[\text{NMC-FID}]}$ = nonmethane cutter CH_4 penetration fraction, according to §1065.365(e).
 $x_{\text{THC}[\text{NMC-FID}]_{\text{cor}}}$ = concentration of THC, HC contamination (optional) and dry-to-wet corrected, as measured by the THC FID during sampling through the NMC.
 $PF_{\text{C}_2\text{H}_6[\text{NMC-FID}]}$ = nonmethane cutter ethane penetration fraction, according to §1065.365(e).

Example:

$x_{\text{THC}[\text{THC-FID}]_{\text{cor}}} = 150.3 \mu\text{mol/mol}$
 $PF_{\text{CH}_4[\text{NMC-FID}]} = 0.990$
 $x_{\text{THC}[\text{NMC-FID}]_{\text{cor}}} = 20.5 \mu\text{mol/mol}$
 $PF_{\text{C}_2\text{H}_6[\text{NMC-FID}]} = 0.020$

$$x_{\text{NMHC}} = \frac{150.3 \cdot 0.990 - 20.5}{0.990 - 0.020}$$

$x_{\text{NMHC}} = 132.3 \mu\text{mol/mol}$

(iii) For penetration fractions determined using an NMC configuration as outlined in §1065.365(f), use the following equation:

$$x_{\text{NMHC}} = \frac{x_{\text{THC}[\text{THC-FID}]_{\text{cor}}} \cdot PF_{\text{CH}_4[\text{NMC-FID}]} - x_{\text{THC}[\text{NMC-FID}]_{\text{cor}}} \cdot RF_{\text{CH}_4[\text{THC-FID}]}}{PF_{\text{CH}_4[\text{NMC-FID}]} - RFPF_{\text{C}_2\text{H}_6[\text{NMC-FID}]} \cdot RF_{\text{CH}_4[\text{THC-FID}]}} \quad \text{Eq. 1065.660-4}$$

Where:

x_{NMHC} = concentration of NMHC.
 $x_{\text{THC}[\text{THC-FID}]_{\text{cor}}}$ = concentration of THC, HC contamination and dry-to-wet corrected, as measured by the THC FID during sampling while bypassing the NMC.

$PF_{\text{CH}_4[\text{NMC-FID}]}$ = nonmethane cutter CH_4 penetration fraction, according to §1065.365(f).
 $x_{\text{THC}[\text{NMC-FID}]_{\text{cor}}}$ = concentration of THC, HC contamination (optional) and dry-to-wet corrected, as measured by the THC FID during sampling through the NMC.

§ 1065.660

40 CFR Ch. I (7–1–10 Edition)

$RFPF_{C_2H_6[NMC-FID]}$ = nonmethane cutter CH_4 combined ethane response factor and penetration fraction, according to §1065.365(f).

$RF_{CH_4[THC-FID]}$ = response factor of THC FID to CH_4 , according to §1065.360(d).

Example:

$$x_{THC[THC-FID]_{cor}} = 150.3 \text{ } \mu\text{mol/mol}$$

$$PF_{CH_4[NMC-FID]} = 0.990$$

$$x_{THC[NMC-FID]_{cor}} = 20.5 \text{ } \mu\text{mol/mol}$$

$$RFPF_{C_2H_6[NMC-FID]} = 0.019$$

$$RF_{CH_4[THC-FID]} = 0.980$$

$$x_{NMHC} = \frac{150.3 \cdot 0.990 - 20.5 \cdot 0.980}{0.990 - 0.019 \cdot 0.980}$$

$$x_{NMHC} = 132.5 \text{ } \mu\text{mol/mol}$$

(3) For a gas chromatograph, calculate x_{NMHC} using the THC analyzer's response factor (RF) for CH_4 , from §1065.360, and the HC contamination and dry-to-wet corrected initial THC concentration $x_{THC[THC-FID]_{cor}}$ as determined in paragraph (a) of this section as follows:

$$x_{NMHC} = x_{THC[THC-FID]_{cor}} - RF_{CH_4[THC-FID]} \cdot x_{CH_4} \quad \text{Eq. 1065.660-5}$$

Where:

x_{NMHC} = concentration of NMHC.

$x_{THC[THC-FID]_{cor}}$ = concentration of THC, HC contamination and dry-to-wet corrected, as measured by the THC FID.

x_{CH_4} = concentration of CH_4 , HC contamination (optional) and dry-to-wet corrected, as measured by the gas chromatograph FID.

$RF_{CH_4[THC-FID]}$ = response factor of THC-FID to CH_4 .

Example:

$$x_{THC[THC-FID]_{cor}} = 145.6 \text{ } \mu\text{mol/mol}$$

$$RF_{CH_4[THC-FID]} = 0.970$$

$$x_{CH_4} = 18.9 \text{ } \mu\text{mol/mol}$$

$$x_{NMHC} = 145.6 - 0.970 \cdot 18.9$$

$$x_{NMHC} = 127.3 \text{ } \mu\text{mol/mol}$$

(c) CH_4 determination. Use one of the following methods to determine CH_4 concentration, x_{CH_4} :

(1) For nonmethane cutters, calculate x_{CH_4} using the nonmethane cutter's penetration fractions (PF) of CH_4 and C_2H_6 from §1065.365, using the dry-to-wet corrected CH_4 concentration $x_{THC[NMC-FID]_{cor}}$ as determined in paragraph (a) of this section and optionally using the CH_4 contamination correction under paragraph (a) of this section.

(i) Use the following equation for penetration fractions determined using an NMC configuration as outlined in §1065.365(d):

$$x_{CH_4} = \frac{x_{THC[NMC-FID]_{cor}} - x_{THC[THC-FID]_{cor}} \cdot RFPF_{C_2H_6[NMC-FID]}}{1 - RFPF_{C_2H_6[NMC-FID]} \cdot RF_{CH_4[THC-FID]}} \quad \text{Eq. 1065.660-6}$$

Where:

x_{CH_4} = concentration of CH_4 .

$x_{THC[NMC-FID]_{cor}}$ = concentration of THC, HC contamination (optional) and dry-to-wet corrected, as measured by the NMC FID during sampling through the NMC.

$x_{THC[THC-FID]_{cor}}$ = concentration of THC, HC contamination and dry-to-wet corrected, as measured by the THC FID during sampling while bypassing the NMC.

$RFPF_{C_2H_6[NMC-FID]}$ = the combined ethane response factor and penetration fraction of the nonmethane cutter, according to §1065.365(d).

$RF_{CH_4[THC-FID]}$ = response factor of THC FID to CH_4 , according to §1065.360(d).

Example:

$$x_{THC[NMC-FID]_{cor}} = 10.4 \text{ } \mu\text{mol/mol}$$

$$x_{THC[THC-FID]_{cor}} = 150.3 \text{ } \mu\text{mol/mol}$$

$$RFPF_{C_2H_6[NMC-FID]} = 0.019$$

$$RF_{CH_4[THC-FID]} = 1.05$$

$$x_{CH_4} = \frac{10.4 - 150.3 \cdot 0.019}{1 - 0.019 \cdot 1.05}$$

$$x_{CH_4} = 7.69 \text{ } \mu\text{mol/mol}$$

(ii) For penetration fractions determined using an NMC configuration as outlined in §1065.365(e), use the following equation:

$$x_{\text{CH}_4} = \frac{x_{\text{THC}[\text{NMC-FID}]_{\text{cor}}} - x_{\text{THC}[\text{THC-FID}]_{\text{cor}}} \cdot PF_{\text{C}_2\text{H}_6[\text{NMC-FID}]}}{RF_{\text{CH}_4[\text{THC-FID}]} \cdot (PF_{\text{CH}_4[\text{NMC-FID}]} - PF_{\text{C}_2\text{H}_6[\text{NMC-FID}]})} \quad \text{Eq. 1065.660-7}$$

Where:

x_{CH_4} = concentration of CH_4 .

$x_{\text{THC}[\text{NMC-FID}]_{\text{cor}}}$ = concentration of THC, HC contamination (optional) and dry-to-wet corrected, as measured by the NMC FID during sampling through the NMC.

$x_{\text{THC}[\text{THC-FID}]_{\text{cor}}}$ = concentration of THC, HC contamination and dry-to-wet corrected, as measured by the THC FID during sampling while bypassing the NMC.

$PF_{\text{C}_2\text{H}_6[\text{NMC-FID}]}$ = nonmethane cutter ethane penetration fraction, according to §1065.365(e).

$RF_{\text{CH}_4[\text{THC-FID}]}$ = response factor of THC FID to CH_4 , according to §1065.360(d).

$PF_{\text{CH}_4[\text{NMC-FID}]}$ = nonmethane cutter CH_4 penetration fraction, according to §1065.365(e).

Example:

$x_{\text{THC}[\text{NMC-FID}]_{\text{cor}}} = 10.4 \mu\text{mol/mol}$

$x_{\text{THC}[\text{THC-FID}]_{\text{cor}}} = 150.3 \mu\text{mol/mol}$

$PF_{\text{C}_2\text{H}_6[\text{NMC-FID}]} = 0.020$

$RF_{\text{CH}_4[\text{THC-FID}]} = 1.05$

$PF_{\text{CH}_4[\text{NMC-FID}]} = 0.990$

$$x_{\text{CH}_4} = \frac{10.4 - 150.3 \cdot 0.020}{1.05 \cdot (0.990 - 0.020)}$$

$x_{\text{CH}_4} = 7.25 \mu\text{mol/mol}$

(iii) For penetration fractions determined using an NMC configuration as outlined in §1065.365(f), use the following equation:

$$x_{\text{CH}_4} = \frac{x_{\text{THC}[\text{NMC-FID}]_{\text{cor}}} - x_{\text{THC}[\text{THC-FID}]_{\text{cor}}} \cdot RFPF_{\text{C}_2\text{H}_6[\text{NMC-FID}]}}{PF_{\text{CH}_4[\text{NMC-FID}]} - RFPF_{\text{C}_2\text{H}_6[\text{NMC-FID}]} \cdot RF_{\text{CH}_4[\text{THC-FID}]}} \quad \text{Eq. 1065.660-8}$$

Where:

x_{CH_4} = concentration of CH_4 .

$x_{\text{THC}[\text{NMC-FID}]_{\text{cor}}}$ = concentration of THC, HC contamination (optional) and dry-to-wet corrected, as measured by the NMC FID during sampling through the NMC.

$x_{\text{THC}[\text{THC-FID}]_{\text{cor}}}$ = concentration of THC, HC contamination and dry-to-wet corrected, as measured by the THC FID during sampling while bypassing the NMC.

$RFPF_{\text{C}_2\text{H}_6[\text{NMC-FID}]}$ = the combined ethane response factor and penetration fraction of the nonmethane cutter, according to §1065.365(f).

$PF_{\text{CH}_4[\text{NMC-FID}]}$ = nonmethane cutter CH_4 penetration fraction, according to §1065.365(f).

$RF_{\text{CH}_4[\text{THC-FID}]}$ = response factor of THC FID to CH_4 , according to §1065.360(d).

Example:

$x_{\text{THC}[\text{NMC-FID}]_{\text{cor}}} = 10.4 \mu\text{mol/mol}$

$x_{\text{THC}[\text{THC-FID}]_{\text{cor}}} = 150.3 \mu\text{mol/mol}$

$RFPF_{\text{C}_2\text{H}_6[\text{NMC-FID}]} = 0.019$

$PF_{\text{CH}_4[\text{NMC-FID}]} = 0.990$

$RF_{\text{CH}_4[\text{THC-FID}]} = 1.05$

$$x_{\text{CH}_4} = \frac{10.4 - 150.3 \cdot 0.019}{0.990 - 0.019 \cdot 1.05}$$

$x_{\text{CH}_4} = 7.78 \mu\text{mol/mol}$

(2) For a gas chromatograph, x_{CH_4} is the actual dry-to-wet corrected CH_4 concentration as measured by the analyzer.

[73 FR 37336, June 30, 2008, as amended at 73 FR 59339, Oct. 8, 2008; 74 FR 56516, Oct. 30, 2009]

§ 1065.665 THCE and NMHCE determination.

(a) If you measured an oxygenated hydrocarbon's mass concentration, first calculate its molar concentration in the exhaust sample stream from which the sample was taken (raw or diluted exhaust), and convert this into a C_1 -equivalent molar concentration. Add these C_1 -equivalent molar concentrations to the molar concentration of NOTHC. The result is the molar concentration of THCE. Calculate THCE concentration using the following equations, noting that equation 1065.665-3 is only required if you need to convert your OHC concentration from mass to moles: