§86.144 Calculations; exhaust emissions

Read Input Data

$i := 1 .. 54$ $input_i := READ(ftpinput)$

Testnumber := $input_1$ Numeric test identifier Testnumber = 199701

Procedure := $input_2$ Procedure = 2 Numeric Test Procedure

§86.144-94(e)
For Phase II California fueled vehicle with measured fuel composition of CxHyOz:

$x := input_{49}$	$x = 1$	Carbon-to-carbon ratio as measured for the fuel used.
$y := input_{50}$	$y = 3.97$	Hydrogen-to-carbon ratio as measured for thefuel used.
$y_{HC} := y$	$y_{HC} = 3.97$	Hydrogen-to-carbon ratio as measured for the fuel used.
$y_{NMHC} := input_{52}$	$y_{NMHC} = 2.596$	Non-Methane Hydrocarbon Hydrogen-to-carbon ratio as measured for the Non-Methane Hydrocarbon components of the fuel used.
$z := input_{53}$	$z = 0$	Oxygen-to-carbon ratio as measured for the fuel used.

FID response to methane

$r_{CH4.ct} := input_7$	$r_{CH4.ct} = 1.114$	FID response to methane.
$r_{CH4.s} := input_8$	$r_{CH4.s} = 1.114$	FID response to methane.
$r_{CH4.ht} := input_9$	$r_{CH4.ht} = 1.114$	FID response to methane.

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For the "transient" phase of the cold-start test, the analyzer concentrations were as follows:

$FIDHC_{ct.e} := input_{10}$	$FIDHC_{ct.e} = 71.917$	Concentration of hydrocarbon plus methane in dilute exhaust as measured by the FID, ppm carbon equivalent.
$NOx_{ct.e} := input_{11}$	$NOx_{ct.e} = 20.859$	Oxides of nitrogen concentration of the dilute exhaust sample as measured, in ppm.
$CO_{ct.e} := input_{12}$	$CO_{ct.e} = 120.853$	Carbon monoxide concentration of the dilute exhaust sample as measured, in ppm.
$CO2_{ct.e} := input_{13}$	$CO2_{ct.e} = 1.504$	Carbon dioxide concentration of the dilute exhaust sample as measured, in percent.
$CH4_{ct.e} := input_{14}$	$CH4_{ct.e} = 59.328$	Concentration of methane in dilute exhaust sample as measured, ppm carbon equivalent.

$FIDHC_{ct.d} := input_{15}$	$FIDHC_{ct.d} = 3.434$	Concentration of hydrocarbon plus methane in dilution air as measured by the FID, ppm carbon equivalent.
$NOx_{ct.d} := input_{16}$	$NOx_{ct.d} = 0.153$	Oxides of nitrogen concentration of the dilution air sample as measured, in ppm.
$CO_{ct.d} := input_{17}$	$CO_{ct.d} = 0$	Carbon monoxide concentration of the dilution air sample as measured, in ppm.
$CO2_{ct.d} := input_{18}$	$CO2_{ct.d} = 0.041$	Carbon dioxide concentration of the dilution air as measured, in percent.
$CH4_{ct.d} := input_{19}$	$CH4_{ct.d} = 1.52$	Concentration of methane in dilution air as measured, ppm carbon equivalent.

$D_{ct} := input_{20}$	$D_{ct} = 3.602$	The measured driving distance from the "transient" phase of the cold start test, in miles.
$V_{mix.ct} := input_{21}$	$V_{mix.ct} = 2790$	Volume of dilute exhaust collected during the transient phase of the cold-start test, in scf.
$K_{H.ct} := input_{22}$	$K_{H.ct} = 0.867$	NOx Humidity Correction Factor

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For the "stabilized" portion of the test, the analyzer concentrations were as follows:

$FIDHC_{s.e} := input_{23}$	$FIDHC_{s.e} = 20.257$	Concentration of hydrocarbon plus methane in dilute exhaust as measured by the FID, ppm carbon equivalent.
$NOx_{s.e} := input_{24}$	$NOx_{s.e} = 6.869$	Oxides of nitrogen concentration of the dilute exhaust sample as measured, in ppm.
$CO_{s.e} := input_{25}$	$CO_{s.e} = 16.543$	Carbon monoxide concentration of the dilute exhaust sample as measured, in ppm.
$CO2_{s.e} := input_{26}$	$CO2_{s.e} = 0.979$	Carbon dioxide concentration of the dilute exhaust sample as measured, in percent.
$CH4_{s.e} := input_{27}$	$CH4_{s.e} = 16.709$	Concentration of methane in dilute exhaust sample as measured, ppm carbon equivalent.

$FIDHC_{s.d} := input_{28}$	$FIDHC_{s.d} = 3.21$	Concentration of hydrocarbon plus methane in dilution air as measured by the FID, ppm carbon equivalent.
$NOx_{s.d} := input_{29}$	$NOx_{s.d} = 0.102$	Oxides of nitrogen concentration of the dilution air sample as measured, in ppm.
$CO_{s.d} := input_{30}$	$CO_{s.d} = 0$	Carbon monoxide concentration of the dilution air sample as measured, in ppm.
$CO2_{s.d} := input_{31}$	$CO2_{s.d} = 0.042$	Carbon dioxide concentration of the dilution air as measured, in percent.
$CH4_{s.d} := input_{32}$	$CH4_{s.d} = 1.52$	Concentration of methane in dilution air as measured, ppm carbon equivalent.

$D_s := input_{33}$	$D_s = 3.872$	The measured driving distance from the "transient" phase of the cold start test, in miles.
$V_{mix.s} := input_{34}$	$V_{mix.s} = 4738$	Volume of dilute exhaust collected during the transient phase of the cold-start test, in scf.
$K_{H.s} := input_{35}$	$K_{H.s} = 0.867$	NOx Humidity Correction Factor

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For the "transient" portion of the hot-start test, the analyzer concentrations were as follows:

$FIDHC_{ht.e} := input_{36}$	$FIDHC_{ht.e} = 45.516$	Concentration of hydrocarbon plus methane in dilute exhaust as measured by the FID, ppm carbon equivalent.
$NOx_{ht.e} := input_{37}$	$NOx_{ht.e} = 14.714$	Oxides of nitrogen concentration of the dilute exhaust sample as measured, in ppm.
$CO_{ht.e} := input_{38}$	$CO_{ht.e} = 15.39$	Carbon monoxide concentration of the dilute exhaust sample as measured, in ppm.
$CO2_{ht.e} := input_{39}$	$CO2_{ht.e} = 1.319$	Carbon dioxide concentration of the dilute exhaust sample as measured, in percent.
$CH4_{ht.e} := input_{40}$	$CH4_{ht.e} = 39.687$	Concentration of methane in dilute exhaust sample as measured, ppm carbon equivalent.

$FIDHC_{ht.d} := input_{41}$	$FIDHC_{ht.d} = 3.21$	Concentration of hydrocarbon plus methane in dilution air as measured by the FID, ppm carbon equivalent.
$NOx_{ht.d} := input_{42}$	$NOx_{ht.d} = 0.102$	Oxides of nitrogen concentration of the dilution air sample as measured, in ppm.
$CO_{ht.d} := input_{43}$	$CO_{ht.d} = 0$	Carbon monoxide concentration of the dilution air sample as measured, in ppm.
$CO2_{ht.d} := input_{44}$	$CO2_{ht.d} = 0.042$	Carbon dioxide concentration of the dilution air as measured, in percent.
$CH4_{ht.d} := input_{45}$	$CH4_{ht.d} = 1.52$	Concentration of methane in dilution air as measured, ppm carbon equivalent.

$D_{ht} := input_{46}$	$D_{ht} = 3.608$	The measured driving distance from the "transient" phase of the cold start test, in miles.
$V_{mix.ht} := input_{47}$	$V_{mix.ht} = 2753$	Volume of dilute exhaust collected during the transient phase of the cold-start test, in scf.
$K_{H.ht} := input_{48}$	$K_{H.ht} = 0.867$	NOx Humidity Correction Factor

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CONSTANTS

$Density_{HC} := 16.33$	Density is grams per cubic foot, at 68ïF and 760 mm Hg pressure.
$Density_{THC} := 16.33$	Density is grams per cubic foot, at 68ïF and 760 mm Hg pressure.
$Density_{NMHC} := 16.33$	Density is grams per cubic foot, at 68ïF and 760 mm Hg pressure.
$Density_{CH4} := 18.89$	Density is grams per cubic foot, at 68ïF and 760 mm Hg pressure.
$Density_{NOx} := 54.16$	Density is grams per cubic foot, at 68ïF and 760 mm Hg pressure.
$Density_{CO} := 32.97$	Density is grams per cubic foot, at 68ïF and 760 mm Hg pressure.
$Density_{CO2} := 51.81$	Density is grams per cubic foot, at 68ïF and 760 mm Hg pressure.

DERIVED DENSITIES

$Density_{HC} := 1.1771 \cdot \left(12.011 + y_{HC} \cdot 1.008\right)$ $Density_{HC} = 18.849$

$Density_{NMHC} := 1.1771 \cdot \left(12.011 + y_{NMHC} \cdot 1.008\right)$ $Density_{NMHC} = 17.218$

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EPA and CARB - Non-methane hydrocarbon concentration of the dilute exhaust sample as measured, in ppm carbon equivalent.

$NMHC_{ct.e} := FIDHC_{ct.e} - r_{CH4.ct} \cdot CH4_{ct.e}$ $NMHC_{ct.e} = 5.826$

$NMHC_{s.e} := FIDHC_{s.e} - r_{CH4.s} \cdot CH4_{s.e}$ $NMHC_{s.e} = 1.643$

$NMHC_{ht.e} := FIDHC_{ht.e} - r_{CH4.ht} \cdot CH4_{ht.e}$ $NMHC_{ht.e} = 1.305$

EPA and CARB - Non-methane hydrocarbon concentration of the dilution air as measured, in ppm carbon equivalent.

$NMHC_{ct.d} := FIDHC_{ct.d} - r_{CH4.ct} \cdot CH4_{ct.d}$ $NMHC_{ct.d} = 1.74$

$NMHC_{s.d} := FIDHC_{s.d} - r_{CH4.s} \cdot CH4_{s.d}$ $NMHC_{s.d} = 1.516$

$NMHC_{ht.d} := FIDHC_{ht.d} - r_{CH4.ht} \cdot CH4_{ht.d}$ $NMHC_{ht.d} = 1.516$

Total hydrocarbon (non-methanol) concentration of the dilute exhaust sample as measured, ppm carbon equivalent, i.e., equivalent propane X 3.

$HC_{ct.e} := FIDHC_{ct.e}$ $HC_{ct.e} = 71.917$

$HC_{s.e} := FIDHC_{s.e}$ $HC_{s.e} = 20.257$

$HC_{ht.e} := FIDHC_{ht.e}$ $HC_{ht.e} = 45.516$

Total hydrocarbon (non-methanol) concentration of the dilution air as measured, in ppm carbon equivalent.

$HC_{ct.d} := FIDHC_{ct.d}$ $HC_{ct.d} = 3.434$

$HC_{s.d} := FIDHC_{s.d}$ $HC_{s.d} = 3.21$

$HC_{ht.d} := FIDHC_{ht.d}$ $HC_{ht.d} = 3.21$

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Dilution factor for Natural Gas fueled vehicles where fuel composition is CxHyOz as measured for the fuel used.

$$DF_{ct} := \frac{100 \cdot \left[\frac{x}{x + \frac{y}{2} + 3.76 \cdot \left[x + \frac{y}{4} \right]} \right]}{CO2_{ct.e} + \left(NMHC_{ct.e} + CH4_{ct.e} + CO_{ct.e} \right) \cdot 10^{-4}} \qquad DF_{ct} = 6.268$$

$$DF_{s} := \frac{100 \cdot \left[\frac{x}{x + \frac{y}{2} + 3.76 \cdot \left[x + \frac{y}{4} \right]} \right]}{CO2_{s.e} + \left(NMHC_{s.e} + CH4_{s.e} + CO_{s.e} \right) \cdot 10^{-4}} \qquad DF_{s} = 9.714$$

$$DF_{ht} := \frac{100 \cdot \left[\frac{x}{x + \frac{y}{2} + 3.76 \cdot \left[x + \frac{y}{4} \right]} \right]}{CO2_{ht.e} + \left(NMHC_{ht.e} + CH4_{ht.e} + CO_{ht.e} \right) \cdot 10^{-4}} \qquad DF_{ht} = 7.207$$

Non-methane concentration of the dilute exhaust sample corrected for background, in ppm carbon equivalent.

$$NMHC_{ct.conc} := NMHC_{ct.e} - NMHC_{ct.d} \cdot \left[1 - \frac{1}{DF_{ct}} \right] \qquad NMHC_{ct.conc} = 4.36$$

$$NMHC_{s.conc} := NMHC_{s.e} - NMHC_{s.d} \cdot \left[1 - \frac{1}{DF_{s}} \right] \qquad NMHC_{s.conc} = 0.28$$

$$NMHC_{ht.conc} := NMHC_{ht.e} - NMHC_{ht.d} \cdot \left[1 - \frac{1}{DF_{ht}} \right] \qquad NMHC_{ht.conc} = -5.29 \cdot 10^{-4}$$

Non-methane hydrocarbon mass, in grams per test phase.

$$NMHC_{ct.mass} := \frac{V_{mix.ct} \cdot Density_{NMHC} \cdot NMHC_{ct.conc}}{10^{6}} \qquad NMHC_{ct.mass} = 0.21$$

$$NMHC_{s.mass} := \frac{V_{mix.s} \cdot Density_{NMHC} \cdot NMHC_{s.conc}}{10^{6}} \qquad NMHC_{s.mass} = 0.023$$

$$NMHC_{ht.mass} := \frac{V_{mix.ht} \cdot Density_{NMHC} \cdot NMHC_{ht.conc}}{10^{6}} \qquad NMHC_{ht.mass} = 0$$

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Methane concentration of the dilute exhaust sample corrected for background, in ppm carbon equivalent.

$$CH4_{ct.conc} := CH4_{ct.e} - CH4_{ct.d} \cdot \left(1 - \frac{1}{DF_{ct}}\right) \qquad CH4_{ct.conc} = 58.05$$

$$CH4_{s.conc} := CH4_{s.e} - CH4_{s.d} \cdot \left(1 - \frac{1}{DF_{s}}\right) \qquad CH4_{s.conc} = 15.34$$

$$CH4_{ht.conc} := CH4_{ht.e} - CH4_{ht.d} \cdot \left(1 - \frac{1}{DF_{ht}}\right) \qquad CH4_{ht.conc} = 38.38$$

Methane hydrocarbon mass, in grams per test phase.

$$CH4_{ct.mass} := \frac{V_{mix.ct} \cdot Density_{CH4} \cdot CH4_{ct.conc}}{10^6} \qquad CH4_{ct.mass} = 3.059$$

$$CH4_{s.mass} := \frac{V_{mix.s} \cdot Density_{CH4} \cdot CH4_{s.conc}}{10^6} \qquad CH4_{s.mass} = 1.373$$

$$CH4_{ht.mass} := \frac{V_{mix.ht} \cdot Density_{CH4} \cdot CH4_{ht.conc}}{10^6} \qquad CH4_{ht.mass} = 1.996$$

Hydrocarbon concentration of the dilute exhaust sample, in ppm carbon equivalent.

$$HC_{ct.conc} := HC_{ct.e} - HC_{ct.d} \cdot \left(1 - \frac{1}{DF_{ct}}\right) \qquad HC_{ct.conc} = 69.031$$

$$HC_{s.conc} := HC_{s.e} - HC_{s.d} \cdot \left(1 - \frac{1}{DF_{s}}\right) \qquad HC_{s.conc} = 17.378$$

$$HC_{ht.conc} := HC_{ht.e} - HC_{ht.d} \cdot \left(1 - \frac{1}{DF_{ht}}\right) \qquad HC_{ht.conc} = 42.752$$

Total hydrocarbon emissions, in grams per test phase.

$$HC_{ct.mass} := \frac{V_{mix.ct} \cdot Density_{HC} \cdot HC_{ct.conc}}{10^6} \qquad HC_{ct.mass} = 3.63$$

$$HC_{s.mass} := \frac{V_{mix.s} \cdot Density_{HC} \cdot HC_{s.conc}}{10^6} \qquad HC_{s.mass} = 1.552$$

$$HC_{ht.mass} := \frac{V_{mix.ht} \cdot Density_{HC} \cdot HC_{ht.conc}}{10^6} \qquad HC_{ht.mass} = 2.218$$

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Oxides of nitrogen concentration of the dilute exhaust sample corrected for background, ppm.

$$NOx_{ct.conc} := NOx_{ct.e} - NOx_{ct.d} \cdot \left(1 - \frac{1}{DF_{ct}}\right) \qquad NOx_{ct.conc} = 20.73$$

$$NOx_{s.conc} := NOx_{s.e} - NOx_{s.d} \cdot \left(1 - \frac{1}{DF_{s}}\right) \qquad NOx_{s.conc} = 6.78$$

$$NOx_{ht.conc} := NOx_{ht.e} - NOx_{ht.d} \cdot \left(1 - \frac{1}{DF_{ht}}\right) \qquad NOx_{ht.conc} = 14.63$$

Oxides of nitrogen emissions, in grams per test phase.

$$NOx_{ct.mass} := \frac{V_{mix.ct} \cdot Density_{NOx} \cdot K_{H.ct} \cdot NOx_{ct.conc}}{10^6} \qquad NOx_{ct.mass} = 2.716$$

$$NOx_{s.mass} := \frac{V_{mix.s} \cdot Density_{NOx} \cdot K_{H.s} \cdot NOx_{s.conc}}{10^6} \qquad NOx_{s.mass} = 1.508$$

$$NOx_{ht.mass} := \frac{V_{mix.ht} \cdot Density_{NOx} \cdot K_{H.ht} \cdot NOx_{ht.conc}}{10^6} \qquad NOx_{ht.mass} = 1.891$$

Carbon monoxide concentration of the dilute exhaust sample corrected for background, ppm.

$$CO_{ct.conc} := CO_{ct.e} - CO_{ct.d} \cdot \left(1 - \frac{1}{DF_{ct}}\right) \qquad CO_{ct.conc} = 120.85$$

$$CO_{s.conc} := CO_{s.e} - CO_{s.d} \cdot \left(1 - \frac{1}{DF_{s}}\right) \qquad CO_{s.conc} = 16.54$$

$$CO_{ht.conc} := CO_{ht.e} - CO_{ht.d} \cdot \left(1 - \frac{1}{DF_{ht}}\right) \qquad CO_{ht.conc} = 15.39$$

Carbon monoxide emissions, in grams per test phase.

$$CO_{ct.mass} := \frac{V_{mix.ct} \cdot Density_{CO} \cdot CO_{ct.conc}}{10^6} \qquad CO_{ct.mass} = 11.12$$

$$CO_{s.mass} := \frac{V_{mix.s} \cdot Density_{CO} \cdot CO_{s.conc}}{10^6} \qquad CO_{s.mass} = 2.58$$

$$CO_{ht.mass} := \frac{V_{mix.ht} \cdot Density_{CO} \cdot CO_{ht.conc}}{10^6} \qquad CO_{ht.mass} = 1.4$$

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Carbon dioxide concentration of the dilute exhaust sample corrected for background, percent.

$$CO2_{ct.conc} := CO2_{ct.e} - CO2_{ct.d} \cdot \left(1 - \frac{1}{DF_{ct}}\right) \qquad CO2_{ct.conc} = 1.469$$

$$CO2_{s.conc} := CO2_{s.e} - CO2_{s.d} \cdot \left(1 - \frac{1}{DF_{s}}\right) \qquad CO2_{s.conc} = 0.941$$

$$CO2_{ht.conc} := CO2_{ht.e} - CO2_{ht.d} \cdot \left(1 - \frac{1}{DF_{ht}}\right) \qquad CO2_{ht.conc} = 1.282$$

Carbon dioxide emissions, in grams per test phase.

$$CO2_{ct.mass} := \frac{V_{mix.ct} \cdot Density_{CO2} \cdot CO2_{ct.conc}}{10^2} \qquad CO2_{ct.mass} = 2124$$

$$CO2_{s.mass} := \frac{V_{mix.s} \cdot Density_{CO2} \cdot CO2_{s.conc}}{10^2} \qquad CO2_{s.mass} = 2310$$

$$CO2_{ht.mass} := \frac{V_{mix.ht} \cdot Density_{CO2} \cdot CO2_{ht.conc}}{10^2} \qquad CO2_{ht.mass} = 1829$$

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(1) For the "transient" portion of the cold start test the above calculations resulted in the following:

$HC_{ct} := HC_{ct.mass}$	Total hydrocarbon equivalent, in grams per test phase.	$HC_{ct} = 3.63$
$CH4_{ct} := CH4_{ct.mass}$	Total hydrocarbon equivalent, in grams per test phase.	$CH4_{ct} = 3.059$
$NMHC_{ct} := NMHC_{ct.mass}$	Total hydrocarbon equivalent, in grams per test phase.	$NMHC_{ct} = 0.21$
$NOx_{ct} := NOx_{ct.mass}$	Oxides of nitrogen, in grams per test phase.	$NOx_{ct} = 2.716$
$CO_{ct} := CO_{ct.mass}$	Carbon monoxide, in grams per test phase.	$CO_{ct} = 11.117$
$CO2_{ct} := CO2_{ct.mass}$	Carbon dioxide in grams per test phase.	$CO2_{ct} = 2124$

(2) For the stabilized portion of the cold start test similar calculations resulted in the following:

$HC_{s} := HC_{s.mass}$	Total hydrocarbon equivalent, in grams per test phase.	$HC_{s} = 1.552$
$CH4_{s} := CH4_{s.mass}$	Total hydrocarbon equivalent, in grams per test phase.	$CH4_{s} = 1.373$
$NMHC_{s} := NMHC_{s.mass}$	Total hydrocarbon equivalent, in grams per test phase.	$NMHC_{s} = 0.023$
$NOx_{s} := NOx_{s.mass}$	Oxides of nitrogen, in grams per test phase.	$NOx_{s} = 1.508$
$CO_{s} := CO_{s.mass}$	Carbon monoxide, in grams per test phase.	$CO_{s} = 2.584$
$CO2_{s} := CO2_{s.mass}$	Carbon dioxide in grams per test phase.	$CO2_{s} = 2310$

(3) For the"transient" portion of the hot start similar calculations resulted in the following:

$HC_{ht} := HC_{ht.mass}$	Total hydrocarbon equivalent, in grams per test phase.	$HC_{ht} = 2.218$
$CH4_{ht} := CH4_{ht.mass}$	Total hydrocarbon equivalent, in grams per test phase.	$CH4_{ht} = 1.996$
$NMHC_{ht} := NMHC_{ht.mass}$	Total hydrocarbon equivalent, in grams per test phase.	$NMHC_{ht} = 0$
$NOx_{ht} := NOx_{ht.mass}$	Oxides of nitrogen, in grams per test phase.	$NOx_{ht} = 1.891$
$CO_{ht} := CO_{ht.mass}$	Carbon monoxide, in grams per test phase.	$CO_{ht} = 1.397$
$CO2_{ht} := CO2_{ht.mass}$	Carbon dioxide in grams per test phase.	$CO2_{ht} = 1829$

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(4) Weighted emission results:

Total hydrocarbon, in grams per vehicle mile.

$$HC_{wm} = 0.43 \cdot \left[\frac{HC_{ct} + HC_{s}}{D_{ct} + D_{s}}\right] + 0.57 \cdot \left[\frac{HC_{ht} + HC_{s}}{D_{ht} + D_{s}}\right]$$

$HC_{wm} = 0.5854$

Methane hydrocarbon, in grams per vehicle mile.

$$CH4_{wm} = 0.43 \cdot \left[\frac{CH4_{ct} + CH4_{s}}{D_{ct} + D_{s}}\right] + 0.57 \cdot \left[\frac{CH4_{ht} + CH4_{s}}{D_{ht} + D_{s}}\right]$$

$CH4_{wm} = 0.5118$

Non-methane hydrocarbon, in grams per vehicle mile.

$$NMHC_{wm} = 0.43 \cdot \left[\frac{NMHC_{ct} + NMHC_{s}}{D_{ct} + D_{s}}\right] + 0.57 \cdot \left[\frac{NMHC_{ht} + NMHC_{s}}{D_{ht} + D_{s}}\right]$$

$NMHC_{wm} = 0.0152$

Oxides of nitrogen, in grams per vehicle mile.

$$NOx_{wm} = 0.43 \cdot \left[\frac{NOx_{ct} + NOx_{s}}{D_{ct} + D_{s}}\right] + 0.57 \cdot \left[\frac{NOx_{ht} + NOx_{s}}{D_{ht} + D_{s}}\right]$$

$NOx_{wm} = 0.5019$

Carbon monoxide, in grams per vehicle mile.

$$CO_{wm} = 0.43 \cdot \left[\frac{CO_{ct} + CO_{s}}{D_{ct} + D_{s}}\right] + 0.57 \cdot \left[\frac{CO_{ht} + CO_{s}}{D_{ht} + D_{s}}\right]$$

$CO_{wm} = 1.0916$

Carbon dioxide, in grams per vehicle mile.

$$CO2_{wm} = 0.43 \cdot \left[\frac{CO2_{ct} + CO2_{s}}{D_{ct} + D_{s}}\right] + 0.57 \cdot \left[\frac{CO2_{ht} + CO2_{s}}{D_{ht} + D_{s}}\right]$$

$CO2_{wm} = 570.4742$