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Temperature Corrections for Nonroad Exhaust Emissions

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Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Purpose

This report documents how the final NONROAD2005 emission inventory model accounts for the effects of temperature on four-stroke exhaust emissions. RVP and temperature also affect both vapor displacement, which is covered in NR-013b ("Refueling Emissions for Nonroad Engine Modeling") as well as diurnal emissions, which are covered in NR-012c ("Nonroad Evaporative Emission Rates").

Background

NONROAD includes effects of ambient temperature on exhaust emissions. The method used in NONROAD is taken directly from the MOBILE5b highway vehicle emission factor model. Only effects on 4-stroke gasoline engine exhaust hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx) are included. We are not aware of any data that could be used to estimate temperature effects on the other pollutants in NONROAD, so no such effects are currently modeled.

Approach

Temperature Effects on Four-Stroke Exhaust Emissions

The details of the temperature correction method from the MOBILE5b model are as follows:

TCF = EXP [A * (Tambient -75)]

where:

TCF = multiplicative Temperature Correction Factor

Tambient = Ambient Temperature, in degrees Fahrenheit
"A" = The coefficient "A" is taken from MOBILE5b for "Bag 2" effects on uncontrolled light-duty gasoline vehicles (LDGV's). "Bag 2" refers to the hot stabilized portion of the test sequence, so no cold-start effects are present. The value of "A" in the above equation depends on high or low temperature (relative to 75F) and on pollutant (HC/CO/NOx). Values for A are:

"A"	Tambient<75	Tambient>75
HC (4-stroke)	- 0.00240	+0.00132
CO (4-stroke)	+0.00158	+0.00375
NOx (4-stroke)	- 0.00892	- 0.00873

These coefficients are applied only to pre-1968 model year vehicles in MOBILE, including both LDGVs and LDGTs. These coefficients for pre-1968 model year vehicles are assumed to apply to all nonroad 4-stroke engines. Due to lack of data, there is no attempt in NONROAD to apply different temperature corrections for different generations of nonroad 4-stroke engine technologies.

For two-stroke engines, conditions differ significantly from those of on-road motor vehicles. Therefore, the 4-stroke corrections from MOBILE5b are not applied to 2-stroke or diesel engines in NONROAD. Due to lack of data for these engine types, temperature effects on exhaust emissions from 2-stroke and diesel engines are not currently included in NONROAD2005.