

Idling Vehicle Emissions for Passenger Cars, Light-Duty Trucks, and Heavy-Duty Trucks

The amount of pollution that a vehicle emits is dependent on many factors. The U.S. Environmental Protection Agency (EPA) has developed a series of computer models that estimate the average emissions for different types of highway vehicles. This fact sheet is one of a series on highway vehicle emission factors. It presents average emission rates for passenger cars, light-duty trucks, (e.g., pickup trucks, sport-utility vehicles), heavy-duty trucks (semi tractor-trailers), and motorcycles when they are idling.

Introduction

There are a number of factors that affect the rate at which any vehicle emits air pollutants, whether the vehicle is being driven or is at idle (engine running, but vehicle not moving). Some of the most important are:

- vehicle type/size (passenger cars, light-duty trucks, heavy-duty trucks, motorcycles)
- vehicle age and accumulated mileage
- fuel used (gasoline, diesel, others)
- ambient weather conditions (temperature, precipitation, wind)
- maintenance condition of the vehicle (well maintained, in need of maintenance, presence and condition of pollution control equipment)

The most current version of the computer model that EPA uses to estimate average in-use emissions from highway vehicles is MOBILE6.2. EPA, the States, and others use this model to estimate total emissions of pollutants generated by highway vehicles in various geographic areas and over specific time periods. The idle emission rates or "emission factors" presented in this fact sheet are based on national data representing the in-use fleet as of July 2008.

The emission rates of hydrocarbons (both volatile organic compounds [VOCs] and Total Hydrocarbons [THC]), carbon monoxide (CO), and nitrogen oxides (NO_x) for idling vehicles are presented in the following tables. In addition, the emission rates of particulate matter (PM₁₀ and PM_{2.5}) are provided for heavy-duty diesel vehicles only because the MOBILE model does not include PM for the other vehicle categories during idle operation.¹ These emission factors assume an “average” properly maintained vehicle, operating on typical gasoline or diesel fuel, on a warm summer day. Emission rates can be higher in very hot weather (especially HC) or in very cold weather (especially CO).

National average values are used for registration distributions by age (what fraction of all cars, or light trucks, in use today are of the current model year, are one to two years old, 2 to 3 years old, and so forth up to 25 years old) and annual mileage accumulation rates by age (newer vehicles tend to be driven more miles per year than do older vehicles). Some of the other primary assumptions incorporated in these emission factors are:

- Ambient temperatures: 72 to 92 °F day time range
- Nominal gasoline volatility: 9.0 psi Reid vapor pressure (RVP)
- Weathered fuel volatility: 8.6 psi RVP
- Gasoline sulfur content: 30 ppm
- Diesel sulfur content: 330 ppm
- Inspection/maintenance program: No
- Reformulated gasoline: No

Note that these emission rates are applicable for relatively short periods of idle time, as observed in drive-thru lanes, at toll gates, at stop lights, and in very heavily congested traffic. These idle emission rates are not applicable to “hoteling” situations for heavy-duty diesel trucks, where the truck engine may be idling for periods of hours at a time with many accessories being operated from the engine power. EPA is currently studying the issue of emissions from heavy-duty

Abbreviations and Acronyms Used

CO:	Carbon monoxide; a regulated pollutant
CO₂:	Carbon dioxide; the primary byproduct of all fossil fuel combustion
g:	gram(s)
g/hr:	grams per hour
g/min:	grams per minute
GVW:	Gross Vehicle Weight
lb:	pound
NO_x:	Nitrogen oxides; a regulated pollutant
PM₁₀:	Particulate matter under 10 microns diameter; a regulated pollutant
PM_{2.5}:	Particulate matter under 2.5 microns diameter, sometimes referred to as “fine particulate”
ppm:	parts per million
psi:	pounds per square inch
RVP:	Reid vapor pressure; a standardized method for expressing the volatility, or tendency to evaporate, of gasoline
THC:	Total hydrocarbons
VMT:	Vehicle miles traveled
VOC:	Volatile organic compounds; equivalent to THC <u>plus</u> aldehydes <u>minus</u> both methane and ethane

diesel trucks during “hoteling” situations; more information on this subject is available on EPA’s SmartWay Transport Partnership Program web site at: www.epa.gov/smartway/idling.htm.

These emission rates also are not applicable for buses (urban transit buses and school buses). Average idle emission estimates for urban and school buses are provided in the fact sheet “Average In-Use Emission Factors for Urban Buses and School Buses” (EPA420-F-08-026).

Idle Emission Rates

The following tables present idle emission factors expressed as grams per hour (g/hr) and grams per minute (g/min) of idle time. Table 1 presents idling emission rates for gasoline-fueled and diesel cars, light-duty trucks, and heavy-duty vehicles, and motorcycles.

Definitions of Vehicle Types

(Gross Vehicle Weight)

- LDGV: Light-duty gasoline-fueled vehicles, up to 6000 lb GVW (gasoline-fueled passenger cars)
- LDGT: Light-duty gasoline-fueled trucks, up to 8500 lb GVW (includes pick-up trucks, minivans, passenger vans, sport-utility vehicles, etc.)
- HDGV: Heavy-duty gasoline-fueled vehicles, over 8500 lb GVW (gasoline-fueled heavy-duty trucks)
- LDDV: Light-duty diesel vehicles, up to 6000 lb GVW (diesel engine passenger cars)
- LDDT: Light-duty diesel trucks, up to 8500 lb GVW (diesel engine light-duty trucks)
- HDDV: Heavy-duty diesel vehicles, over 8500 lb GVW (diesel engine heavy-duty trucks)
- MC: Motorcycles (only those certified for highway use; all are gasoline-fueled)

The HDDV column represents the average of all diesel engine vehicles over 8,500 lb gross vehicle weight (GVW); this category is dominated by the heaviest HDDVs (GVW Classes VIIIa and VIIIb) which exceed 33,000 lb GVW.

Table 1: Average Idle Emission Rates by Pollutant and Vehicle Type²

Pollutant	Units	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
VOC	g/hr	2.683	4.043	6.495	1.373	2.720	3.455	19.153
	g/min	0.045	0.067	0.108	0.023	0.045	0.058	0.319
THC	g/hr	3.163	4.838	7.260	1.353	2.680	3.503	21.115
	g/min	0.053	0.081	0.121	0.023	0.045	0.058	0.352
CO	g/hr	71.225	72.725	151.900	7.018	5.853	25.628	301.075
	g/min	1.187	1.212	2.532	0.117	0.098	0.427	5.018
NO _x	g/hr	3.515	4.065	5.330	2.690	3.705	33.763	1.625
	g/min	0.059	0.068	0.089	0.045	0.062	0.563	0.027
PM _{2.5}	g/hr	N/A ¹	N/A ¹	N/A ¹	N/A ¹	N/A ¹	1.100	N/A ¹
	g/min	N/A ¹	N/A ¹	N/A ¹	N/A ¹	N/A ¹	0.018	N/A ¹
PM ₁₀	g/hr	N/A ¹	N/A ¹	N/A ¹	N/A ¹	N/A ¹	1.196	N/A ¹
	g/min	N/A ¹	N/A ¹	N/A ¹	N/A ¹	N/A ¹	0.020	N/A ¹

Table 2 presents HDDV idle emission rates by weight class. The GVW weight classes are:

Heavy-Duty Diesel Vehicle Classifications (Gross Vehicle Weight)	
IIb:	8,501-10,000 lb (e.g., full-size pick-up trucks, very large passenger vans)
III:	10,001-14,000 lb (e.g., panel trucks, small enclosed delivery trucks)
IV:	14,001-16,000 lb (e.g., city delivery trucks, landscape utility trucks)
V:	16,001-19,500 lb (e.g., bucket utility trucks, large walk-in delivery trucks)
VI:	19,501-26,000 lb (e.g., rack trucks, single axle vans)
VII:	26,001-33,000 lb (e.g., tow trucks, garbage collection trucks)
VIIIa:	33,001-60,000 lb (e.g., long-haul semi-tractor trailer rigs)
VIIIb:	> 60,000 lb (e.g., long-haul semi-tractor trailer rigs)

Table 2: Average Idle Emission Rates for Heavy-Duty Diesel Vehicles by GVW Class³

Pollutant	Units	IIb	III	IV	V	VI	VII	VIIIa	VIIIb
VOC	g/hr	1.465	1.555	2.025	2.120	2.820	3.503	3.518	4.218
	g/min	0.024	0.026	0.034	0.035	0.047	0.058	0.059	0.070
THC	g/hr	1.498	1.580	2.055	2.150	2.865	3.553	3.565	4.270
	g/min	0.025	0.026	0.034	0.036	0.048	0.059	0.059	0.071
CO	g/hr	9.305	10.068	12.898	13.183	15.163	19.055	26.548	34.473
	g/min	0.155	0.168	0.215	0.220	0.253	0.318	0.442	0.575
NO _x	g/hr	12.668	13.530	17.850	18.655	24.325	30.343	35.758	42.345
	g/min	0.211	0.226	0.298	0.311	0.405	0.506	0.596	0.706
PM _{2.5}	g/hr	1.103	1.010	1.065	1.008	1.069	1.093	1.070	1.114
	g/min	0.018	0.017	0.018	0.017	0.018	0.018	0.018	0.019
PM ₁₀	g/hr	1.199	1.098	1.157	1.095	1.162	1.188	1.163	1.211
	g/min	0.020	0.018	0.019	0.018	0.019	0.020	0.019	0.020

For More Information

The other fact sheets in this series and additional information are available on the Office of Transportation and Air Quality's Web site at:

Emission factor fact sheets:

www.epa.gov/otaq/consumer.htm

Modeling and estimating vehicle emissions:

www.epa.gov/otaq/models.htm

Fuel economy:

www.epa.gov/fueleconomy
www.fueleconomy.gov/

Improving fuel economy and reducing emissions:

www.epa.gov/epahome/trans.htm
www.fueleconomy.gov/feg/drive.shtml

Finding the "greenest" vehicle:

www.epa.gov/greenvehicles

Endnotes

1. The MOBILE model includes PM estimates for heavy-duty diesel vehicles only during idle operation because there has been insufficient emission testing of PM for gasoline-fueled vehicles of the type necessary to develop emission rates for these vehicles at idle, since the PM contribution to ambient air quality from gasoline vehicles and the few light duty diesel cars and trucks in the fleet is normally negligible.

2. Figures presented in this fact sheet are averages only. Individual vehicles can differ substantially in the amount of pollution emitted while idling from the values indicated here. Emission rates may differ slightly from original sources due to rounding.
3. All of the emission estimates provided in this document are consistent, in terms of assumptions made and modeling methodology, with those provided in the other fact sheets in this series: “Average Annual Emissions and Fuel Consumption for Gasoline-Fueled Passenger Cars and Light Trucks” (EPA420-F-08-024), “Average In-Use Emissions from Heavy-Duty Trucks” (EPA420-F-08-027), and “Average In-Use Emission Factors for Urban Buses and School Buses” (EPA420-F-08-026).