
Emission Facts

Average Carbon Dioxide Emissions Resulting from Gasoline and Diesel Fuel

The U.S. Environmental Protection Agency (EPA) developed this series of four fact sheets to facilitate consistency of assumptions and practices in the calculation of emissions of greenhouse gases from transportation and mobile sources. They are intended as a reference for anyone estimating emissions benefits of mobile sources air pollution control programs.

Carbon content in motor vehicle fuels

One of the primary determinants of carbon dioxide (CO₂) emissions from mobile sources is the amount of carbon in the fuel. Carbon content varies, but typically we use average carbon content values to estimate CO₂ emissions.

The Code of Federal Regulations (40 CFR 600.113) provides values for carbon content per gallon of gasoline and diesel fuel which EPA uses in calculating the fuel economy of vehicles:

Gasoline carbon content per gallon: 2,421 grams
Diesel carbon content per gallon: 2,778 grams

Note that for the "Inventory of U.S. Greenhouse Gas Emissions and Sinks," EPA estimates CO₂ emissions from fuel from the heat content of the fuel and carbon content coefficients in terms of carbon content per quadrillion BTU (QBTU), using data from the Energy Information Administration (EIA). EIA's numbers are derived from carbon content by mass, and equate to roughly the same carbon content per gallon of fuel as the values provided in 40 CFR 600.113. EPA uses heat content data from Energy Information Administration's (EIA) "Annual Energy Outlook 2003" and carbon content from EIA's "Emissions of Greenhouse Gases in the United States, 2000."

Note also that these estimates are based only on an average carbon content of conventional gasoline and diesel fuel, and do not specifically address the impact of fuel additives such as ethanol or methyl tertiary-butyl ether (MTBE) that may depend on the feedstock.

Calculating CO₂ emissions

The Intergovernmental Panel on Climate Change (IPCC) guidelines for calculating emissions inventories require that an oxidation factor be applied to the carbon content to account for a small portion of the fuel that is not oxidized into CO₂. For all oil and oil products, the oxidation factor used is 0.99 (99 percent of the carbon in the fuel is eventually oxidized, while 1 percent remains un-oxidized.)¹

Finally, to calculate the CO₂ emissions from a gallon of fuel, the carbon emissions are multiplied by the ratio of the molecular weight of CO₂ (m.w. 44) to the molecular weight of carbon (m.w.12): 44/12.

CO₂ emissions from a gallon of gasoline = 2,421 grams x 0.99 x (44/12)
= 8,788 grams = 8.8 kg/gallon = 19.4 pounds/gallon

CO₂ emissions from a gallon of diesel = 2,778 grams x 0.99 x (44/12) =
10,084 grams = 10.1 kg/gallon = 22.2 pounds/gallon

Note: These calculations and the supporting data have associated variation and uncertainty. EPA may use other values in certain circumstances, and in some cases it may be appropriate to use a range of values.

¹ Based on emissions data, EPA's Office of Transportation and Air Quality (OTAQ) is currently examining whether this fraction is higher (closer to 100 percent) for gasoline.

For More Information

You can access documents on greenhouse gas emissions on the Office of Transportation and Air Quality Web site at:

www.epa.gov/otaq/greenhousegases.htm

For further information on calculating emissions of greenhouse gases, please contact Ed Coe at:

U. S. Environmental Protection Agency
Office of Transportation and Air Quality
1200 Pennsylvania Ave., NW (6406J)
Washington, DC 20460
202-343-9629
E-mail: coe.edmund@epa.gov