

Road Transport Emission Factors: 2010 NAEI

July 2012

Emissions from road vehicles depend on a number of influencing factors and require fairly detailed models to take them all into account. These include the age and composition of the fleet, the size or weight of the vehicle, the emission standards the vehicles complied with when sold new, abatement technologies used to reduce emissions, the type and quality of fuel used, the way the vehicle is driven, trip characteristics and temperature conditions.

The NAEI uses a set of emission factors published by TRL on behalf of DfT in 2009 for many different vehicle classes. These are based on analysis of emissions test data for in-service vehicles measured over a range of different drive cycles. Emission factors for NO_x have been revised for the 2010 NAEI released in 2012, and now use the COPERT 4 v8.1 emission factors published in May 2011. COPERT is a software tool developed by the European Environment Agency and used widely to calculate emissions from road transport in Europe. The COPERT 4 v8.1 factors are based on new sources of information on vehicle emissions emerged since the DfT emission factors were developed. The factors are expressed in grammes emitted per kilometre driven wherever possible as a function of average speed or road type.

The detailed set of DfT/TRL factors and accompanying reports are available at <http://www.dft.gov.uk/publications/road-vehicle-emission-factors-2009>. The latest version of the COPERT model is available for download from <http://www.emisia.com/copert/>. Both data sources are supplemented in the NAEI by factors taken from the EMEP/EEA Guidebook for emissions inventory reporting at <http://www.eea.europa.eu/publications/emep-eea-emission-inventory-guidebook-2009>. From this, revised factors for N₂O emissions from HGVs and buses were used.

The NAEI uses these factors with detailed activity data (total vehicle km travelled each year, national fleet composition, fuel consumed etc) in a methodology described in detail in the UK inventory reports for air pollutants and greenhouse gases at:

http://uk-air.defra.gov.uk/reports/cat07/1203221052_UK_IIR_2012_final.pdf and

http://uk-air.defra.gov.uk/reports/cat07/1104281001_ukghgi-90-09_Annexes_issue2.pdf - note that the 2012 update of this report, which contains the information consistent with these factors, has not yet been published.

Note that CO₂ emission factors are consistent with the Greenhouse Gas Company Reporting Factors, which can be found at: <http://www.defra.gov.uk/environment/economy/business-efficiency/reporting/>. The CO₂ figures presented here include an update of the CO₂ factors for HGVs and buses to be consistent with figures provided by DfT from surveys on the average fuel efficiency of HGVs and local buses.

Emission factors are provided here for a selection of pollutants of specific importance to road transport in a simplified form that reflects the composition of the UK fleet and journeys made in 2010. They are **implied emission factors** derived by taking the overall emissions in 2010 for each vehicle type, calculated by the national emissions inventory methodology, and dividing by total vehicle km travelled or number of vehicles or trips made in 2010. The emissions are taken from the 2010 version of the NAEI released in early 2012. For these factors, the composition of the fleet has been informed for the first time by Automatic Number Plate Recognition data on different types of roads provided by DfT combined with vehicle licensing statistics. The factors therefore vary from previous versions published here partly as a reflection of the methodological changes and changes to input data sets, as well as a reflection of the gradual refreshing of the UK fleet with new, cleaner vehicles displacing older, high emitting vehicles.

Factors are provided for each main process by which emissions occur and at different levels of detail in terms of emission type, vehicle category and road class. Users can then choose a set of factors that best matches the level of detail in their own traffic activity data.

The different emission processes are:

Hot exhaust emissions – these are the tailpipe emissions in g/km from a vehicle with its engine warmed up to its normal operating temperature.

Cold start exhaust emissions – these are the additional tailpipe emissions in g/trip from a vehicle starting a journey with its engine cold. Cold start emission factors are only available for light duty vehicles and for certain pollutants

Evaporative emissions – these are the emissions of NMVOCs or benzene from the evaporation of fuel vapour from a vehicle. These occur only for petrol vehicles because diesel is a much less volatile fuel. There are emission factors for three different evaporative emission processes:

- **Diurnal loss emissions in g/day.** These are emissions arising from expansion of fuel vapour in the petrol tank as temperature rises each day. These occur for all petrol vehicles regardless of whether or how much the vehicle travels
- **Hot soak emission in g/trip.** These are the emissions occurring from the fuel system when the engine is turned off at the end of a trip. Emissions are due to the transfer of heat from the engine and hot exhaust to the fuel system where fuel is no longer flowing
- **Running loss in g/km.** These are evaporative losses that occur while the vehicle is in motion

A change in methodology in the 2009 version of the NAEI explains the differences with previously published versions of these evaporative emission factors. More detailed information can be found in the 2009 UK inventory report - http://uk-air.defra.gov.uk/reports/cat07/1103150849_UK_2011_CLRTAP_IIR.pdf

Tyre wear and brake wear – these are the non-exhaust emissions of PM₁₀ and PM_{2.5} in g/km arising from the mechanical wear of tyre material and brake linings.

Road abrasion – these are the non-exhaust emissions of PM₁₀ and PM_{2.5} in g/km arising from the abrasion and deterioration of road surfaces.

The emission factors are provided in different levels of detail:

1. hot exhaust emissions by vehicle type, fuel type and by road type; these are the most detailed forms and should be used in conjunction with calculation of cold start and evaporative emissions (in the case of NMVOCs and benzene) if separate trip data are available
2. emissions combining hot exhaust, cold start and evaporative emissions in g/km for all cars and all LGVs by road type in g/km. These should be used if the user wants an average factor for cars and LGVs of all fuel types because details of the fuel split are not known and the user has no way of calculating cold start and evaporative emissions independently
3. emissions combining hot exhaust, cold start and evaporative emissions in g/km for each main vehicle type averaged overall all road types. These should be used if the user wants an average factor covering all road conditions and has no way of calculating cold start and evaporative emissions independently

These factors will be updated annually after submission of each version of the NAEI's UK inventory figures.

Any queries regarding the factors should be directed to air.emissions@aeat.co.uk