

Road Transport Emission Factors: 2011 NAEI

April 2013

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 were revised for the 2010 version of the NAEI released in 2012, and now use the COPERT 4 v8.1 emission factors published in May 2011 (which remain the same in COPERT 4 v9.0). Emission factors from COPERT 4 v9.0 for total hydrocarbons (and derived NMVOC EFs) and particulate matter have been adopted in the 2011 inventory released in early 2013.**

COPERT is a software tool developed by the European Environment Agency and used widely to calculate emissions from road transport in Europe. The factors are expressed in grammes emitted per kilometre driven wherever possible as a function of average speed or road type.

The TRL/DfT emission factors for all other pollutants are continued to be used in the 2011 inventory.

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>

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 2013 UK inventory reports for air pollutants and greenhouse gases covering the inventory up to 2011 at:

http://uk-air.defra.gov.uk/reports/cat07/1303261254_UK_IIR_2013_Final.pdf

http://uk-air.defra.gov.uk/reports/cat07/1304171048_ukghgi-90-11_main_chapters_Issue2.pdf

Note that CO₂ emission factors are consistent with the Greenhouse Gas Conversion Factors for Company Reporting Factors, which can be found at:

<http://www.defra.gov.uk/environment/economy/business-efficiency/reporting/>

The 2013 update of DECC/Defra's GHG Company Reporting Guidelines, providing updated CO₂ factors for vehicles representative of the fleet in 2011 is due in the late Spring of 2013. The figures for CO₂ here will be updated after the factors for the Guidelines are released and will also 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. In the interim, the CO₂ factors representing the fleet in 2010 can be used from the July 2012 version of these factors.

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 2011. They are implied emission factors derived by taking the overall emissions in 2011 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 2011. The emissions are taken from the 2011 version of the NAEI released in early 2013. **As for the 2010 inventory, the composition of the fleet has been informed by Automatic Number Plate Recognition**

data on different types of roads provided by DfT combined with vehicle licensing statistics. The factors vary from previous versions published here partly due to the implementation of COPERT 4 emission factors for VOCs and PM, 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. Hence the changes in these factors compared with the 2010NAEI factors published in 2012 reflect partly methodological changes and partly 'real' changes in vehicle fleet emissions occurring between 2010 and 2011 due to refreshing of the fleet.

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

More detailed information can be found in the UK inventory report referred to above

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@ricardo-aea.com