Road Transport Emission Factors: 2018 NAEI
April 2020

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 main sources of emission factors used by the NAEI are:

- COPERT 5 (COPERT is a software tool developed by the European Environment Agency and is used widely to calculate national emissions from road transport in Europe)
- EMEP/EEA Emission Inventory Guidebook 2019

These are based on analysis of emissions test data for in-service vehicles measured over a range of different drive cycles. The factors are expressed in grams emitted per kilometre driven wherever possible as a function of average speed or road type.

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: https://www.eea.europa.eu/publications/emep-eea-guidebook-2019

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 2020 UK inventory reports for air pollutants and greenhouse gases covering the inventory up to 2018 at:

http://uk-air.defra.gov.uk/reports/cat07/2003131327_GB_IIR_2020_v1.0.pdf

https://unfccc.int/ghg-inventories-annex-i-parties/2020 (available from 15 April 2019)

The Department for Business, Energy & Industrial Strategy (BEIS) provides greenhouse gas conversion factors for company reporting, which can be found at:

https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting

Please refer to this tool for CO_2 factors for road vehicles.

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 2018. They are implied emission factors derived by taking the overall emissions in 2018 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 2018. The emissions are taken from the 2018 version of the NAEI released in early 2020. As for the previous inventories, the composition of the fleet has been informed by Automatic Number Plate Recognition data on different types of roads provided by the Department for Transport (DfT) combined with vehicle licensing statistics. **The factors vary from previous versions published here as a reflection of any methodological (or emission factors) changes made to the 2018 version of the NAEI, as well as the gradual refreshing of the UK fleet with new, cleaner vehicles displacing older, high emitting vehicles, amongst other reasons.**

The most notable change relative to the previous version is for the NO_x, CO, Benzene and NMVOC emission factors from motorcycles, due to the implementation of updated emissions factors from the 2019 EMEP/EEA Emission Inventory Guidebook. The largest impact is for the CO motorcycle emission factors on motorways where the emission factor is 43% of the previous emission factor from the previous version.

In most cases the emission factors provided are lower than those provided in the previous version. This is because the proportion of more modern and typically less emissive vehicles in the fleet has increased relative to the previous year. An exception to this is NH_3 and N_2O emission factors from diesel-fuelled vehicles as the more modern later Euro Standard vehicles tend to emit more NH_3 and N_2O due to slippage from the Selective Catalytic Reduction (SCR) systems for NO_x control used.

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 cars and light goods 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 PM_{10} 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 PM_{10} 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 over 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.