



Real Driving NO_x Emissions and Emission Manipulations of Trucks observed with Plume Chasing

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Traffic is the main source of NO_x (NO₂ + NO) emissions, especially from diesel engines. EURO V and EURO VI trucks use new SCR emission cleaning systems. Opposite to diesel cars, trucks achieve with SCR systems significantly lower emissions also for real driving. However, truck drivers need to refill AdBlue for the SCR system regularly and replace the SCR system after longer mileage. Illegal manipulation tools, so called emulators, got very popular to turn off the SCR emission system and thus save money. These manipulations result in several time higher NO_x emissions. Emulators are available as small hardware tools or as software uploaded to the truck electronic. So far, there are not many possibilities for official agencies to find these manipulations in a truck control and real manipulation levels remain unknown.

Using PEMS (Portable EMISSION Systems) or RS (Remote Sensing) to investigate these high emitters is not practical, the former are very complicated to operate and expensive while the later derive not a reliable emission level for an individual vehicle due to its short measurement.

We perform Plume Chasing, a new kind of real driving emission measurements. Measurement are performed in the diluted emission plume behind the truck using a following car. For these studies, we apply our newly developed NO_x / CO₂ ICAD mobile measurement system. The emission is calculated from ratios of measured NO_x to CO₂ concentrations in the plume.

We performed detailed validation of Plume Chasing with PEMS for EURO VI down to EURO II trucks. Typically, we observe a very good correlation (R=0.88%). High and low emitters are reliable identified. It was found that the reliable identification of a high emitter, e.g. due to an emulator, need an emission measurement over about 5 minutes. Plume Chasing is probably currently the most reliable method to easily identify individual high emitters. In different studies in Germany, Switzerland and Austria we investigated high truck emitters due to manipulated or defective SCR systems. Many trucks show consistently high emissions, which originate almost exclusively from east and south Europe. Up to 35% of EURO V trucks are affected and up to 25% of EURO VI trucks. Thus, manipulations are likely also affect EURO VI trucks. The percentage is much higher than for official controls, which is not surprising as the emulators are difficult to find. The large amount of high truck emitters has a significant impact of total NO_x Emissions of the transport sector.