Euro 6 unregulated pollutant characterization and statistical analysis of the impact of aftertreatment devices and driving conditions on recent passenger cars emissions

Simon Martinet\textsuperscript{a}, Yao Liu\textsuperscript{a,*}, Cédric Louis\textsuperscript{a,b}, Patrick Tassel\textsuperscript{a}, Pascal Perret\textsuperscript{a}, Agnès Chaumond\textsuperscript{a}, Michel André\textsuperscript{a}

\textsuperscript{a} Transport and Environment Laboratory, IFSTTAR, 69675 Bron, France
\textsuperscript{b} French Environment and Energy Management Agency, ADEME, 49004 Angers, France

Keywords: Regulated and unregulated pollutants; Emission factors; Euro 6 vehicles; Chassis dynamometer; Driving conditions; Aftertreatment systems

Presenting author email: simon.martinet@ifsttar.fr

This study aims to measure and analyze unregulated compound emissions for two Euro 6 vehicles: one diesel vehicle with a catalyzed particulate filter and NO\textsubscript{X} trap, and one gasoline vehicle with a direct injection system and propulsion engine. The vehicles were tested on a chassis dynamometer under various driving cycles: Artemis driving cycles (urban, road and motorway) — which are representative of real-world driving conditions, the New European Driving Cycle (NEDC) and the World Harmonized Light-Duty Test Cycle (WLTC) for Europe, and world approval cycles. The emissions of unregulated compounds — such as total particle number (PN) (over 5.6 nm), black carbon (BC), NO\textsubscript{2}, BTEX (benzene, toluene, ethylbenzene and xylene), carbonyl compounds and polycyclic aromatic hydrocarbons (PAHs) — were measured with several on-line devices and different samples were collected using cartridges and quartz filters.

Furthermore, a preliminary statistical analysis was performed on eight Euro 4-6 diesel and gasoline vehicles to study the impacts of driving conditions and aftertreatment and engine technologies on emissions of regulated and unregulated pollutants. The results indicate that urban conditions with cold start induce high emissions of BTEX and carbonyl compounds and that urban conditions with hot start induce high emissions of NO\textsubscript{X}. Motorway conditions are characterized by high emissions of particle numbers and CO, which mainly induced by gasoline vehicles. Compared with gasoline vehicles, diesel vehicles equipped with catalyzed or additive DPF emit fewer particles but more NO\textsubscript{X} and carbonyl compounds.

This work was supported by FEVER (1366C0051) and CaPVeREA (1466C0001) projects funded by the French Environment and Energy Management Agency (ADEME).