



Sustainable Transport Unit VELA - Vehicle Emission Laboratories

The Ispra, Italy-based Vehicle Emissions Laboratory (VELA) comprises two well-equipped chemical and physical analysis labs, and seven major testing facilities capable of conducting emissions tests (including the measurement of evaporative emissions) on a variety of vehicles. These range from motorbikes to passenger cars and large heavy-duty engines. Findings made at these facilities have provided scientific support for the development of new EU Directives and the revision of older ones, as well as for the assessment of new measurement techniques and procedures. They have also provided answers to other scientific challenges, such as the toxicity of emissions from motorcycles. Below you will find a short description of the various activities of the VELA Laboratory.



The VELA research activities cover all environmental aspects of advanced technologies, new engines and after-treatment systems, onboard diagnostic systems, new or reformulated fuels, and bio-fuels and gaseous fuels. This facility also comprises the chemical analysis of particulate matter and volatile organics. The analysis helps create fingerprints used for source apportionment. Further to classical combustion engine emissions testing, the staff perform cost-benefit analysis of cleaner transport technology options and of technology foresight through a Life Cycle Analysis (LCA) of transport fuels. The testing of electrical, hybrid, hydrogen (H₂) and fuel cell vehicles' energy efficiency completes the process.

VELA, equipped with the most advanced facilities and instrumentation, is able to characterise physical/chemical and toxicological emissions from all types of transport means. Tests are conducted on various engines, from small hand-held (e.g. chain saws) to large heavy-duty, and on full vehicles including mopeds, motorbikes, passenger cars, 4WD (four-wheel drive) cars, heavy-duty trucks and buses. Laboratory and test bench analysis of tailpipe emissions is accompanied by innovative research into real-world emissions from combustion engines. For some time now, the JRC has been testing the so-called Portable Emission Measurement System (PEMS) on heavy-duty trucks and buses running in their normal working environment. Similar systems will also be used on passenger cars, working machinery, ships and locomotives in the future; this will help scientists to optimise how engines and after-treatment systems function in real-world operating conditions.



VELA 1 & 2

The test cells VELA 1 and VELA 2 have the capacity to measure pollutant emissions from light duty vehicles (cars, vans, small trucks) as well as from motorcycles and mopeds. In both cells, it is possible to vary the test temperature to study its effect on emissions; in particular, it is possible to test vehicles at low ambient temperatures (down to -10 °C). VELA 2 is also equipped with a roller bench for 4WD vehicles.



VELA 3

VELA 3 is a test cell dedicated to the measurement of vehicle-generated evaporative emissions. These emissions come mainly from the evaporation of fuel in the tank and in the injection system and contribute to the total emissions of volatile organic compounds. The legislative procedure prescribes leaving the vehicle in the cell for 24 hours while the temperature is varied between 20 °C and 35 °C, simulating parking conditions during a summer's day.



VELA 4,5,6

VELA also comprises test beds for measuring emissions generated by engines of different size. The engine, installed on a specific support, is coupled to an electric brake that applies a variable load, thus simulating the operating conditions of the corresponding driving cycle.



VELA 7

VELA 7 is the latest emission test cell that facilitates the measurement of emissions from heavy-duty vehicles. The dynamometer can simulate different driving cycles while the test temperature can be varied between +50 °C and -30 °C. This laboratory is essential for making an accurate assessment of the emissions of heavy-duty vehicles in their actual service conditions, as well as for testing prototype vehicles.

Besides the regulated pollutants (unburned hydrocarbons, carbon monoxide, nitrogen oxides and particulate matter), in each test cell it is possible to measure unregulated emissions, namely: specific hydrocarbons (e.g. benzene), aldehydes or number and size of particles.

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