EMISSIONS ANALYTICS

Additive test results: gasoline

25 February 2016

Objectives

The objective was to evidence the effect on the emissions and fuel economy in real-world driving of passenger vehicles after the application of Petrox Universal.

Test vehicles

The headline details of test vehicle are:

Make	Model	Engine size (litres)	Fuel	Euro stage
Vauxhall	Insignia	1.8	Petrol	Euro 5

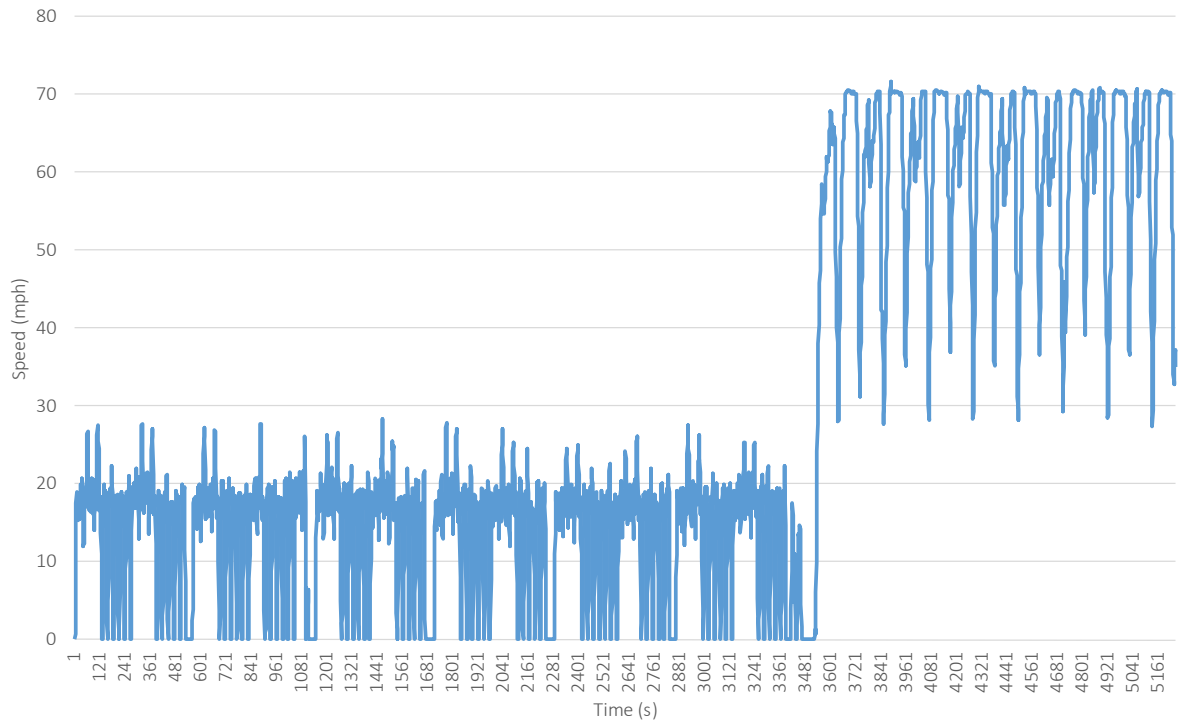
Testing equipment

The emissions tests were conducted with a Sensors SEMTECH-DS for gaseous emissions (below left). No permanent modification to the vehicles was required to install the equipment. To measure the total mass flow of gas a Sensors flow tube was used, mounted on the exterior of the vehicle.

Particulates were measured by the Pegasor Mi2, which is a real-time sampler of the raw exhaust (above right). It uses a corona diffusion charger, configured to measure particle number concentration.

Test protocol

Vehicles were tested on a simulated real-world cycle on a track, in order to avoid the effects of unpredictable traffic flow. The real, on-road cycle was made up of a combination of urban and extra-urban elements:



It was decided with the client to eliminate the 60 mph part of the proposed test cycle in order to test a greater number of dosage levels.

For the Vauxhall, the following test plan was followed:

1. Test without additive
2. Add x8 dose of additive, followed by 40 miles of accumulation including heaving acceleration
3. Test

In all cases, the vehicle was fully warmed up before the test and carrying payload equivalent to a driver, passenger and the test equipment of around 100 kg.

Measurements

The following emissions were monitored:

- CO_2
- CO
- NO_x (comprising NO and NO_2 measured independently)
- Particulate number

Fuel economy is derived using the carbon balance method.

Summary of results

The test programme was successfully conducted between 4 and 7 February 2016.

The headline results are:

- The additive gave a statistically significant (at 90%) uplift of 3.9% in fuel economy at motorway speeds, with a small non-significant decline on the urban cycle
- On the motorway cycle, the reduction in CO_2 emissions was 2.8% and the reduction in CO emissions was 12.7%, both of which were statistically significant
- Large reductions in NO_x emissions were seen in both urban and motorway driving, with an overall reduction of 43.8%, which was statistically significant at 99%

Detailed results

The results quoted below are pre-additive compared to the x8 dose ("post"). Statistically significant results at 90% or above are highlighted in green. A Student one-tailed test is used to test for an improvement in performance.

	Fuel economy (MPG)				Carbon dioxide (g/km)			
	Pre	Post	Variance	%	Pre	Post	Variance	%
Urban	17.5	17.1	(0.4)	(2.1%)	389.3	397.4	8.1	2.1%
Motorway	28.9	30.0	1.1	3.9%	228.7	222.4	(6.3)	(2.8%)
Combined	**21.8**	**21.8**	**0.0**	**0.1%**	**309.0**	**309.9**	**0.9**	**0.3%**

	Carbon monoxide (g/km)				Nitrogen oxides (g/km)			
	Pre	Post	Variance	%	Pre	Post	Variance	%
Motorway	9.014	7.869	(1.145)	(12.7%)	0.057	0.034	(0.023)	(40.6%)
Combined	**4.994**	**4.448**			**0.051**	**0.029**		

Particle number (# scaled/km)				
	Pre	Post	Variance	%
Urban	8.7	11.4	2.7	30.8%
Motorway	85.3	66.8	(18.5)	(21.7%)
Combined	**47.0**	**39.1**	**(7.9)**	**(16.8%)**