

Gasoline Direct Injection (GDI) HC emissions

Turbo-charged, homogeneous-charge GDI engines are becoming more popular than port-fuel-injected (PFI) gasoline engines because they bring fuel economy benefits in addition to accurate transient fuelling control. However, it remains important to avoid fuel injection strategies or cylinder geometries which produce poor combustion or “wall-wetting”. Such problems are difficult to solve in the previous stratified, wall-guided GDI systems, but spray-guided (or air-guided) systems tend to produce lower HC emissions as fuel droplet impingement on surfaces can be minimised.

A reasonable 3-way catalyst can convert almost all of the HC which may remain in the engine-out gas following combustion and from cumulative emissions graphs, it is clear that the catalyst heating phase of the engine warm-up is crucial to achieving the catalyst’s desired state.

A plot of the HC emissions (both cumulative and instantaneous) showing the engine-out and tailpipe HC emissions from a 1.6-litre Euro IV-compliant turbo-charged GDI vehicle is show in Figure 1.

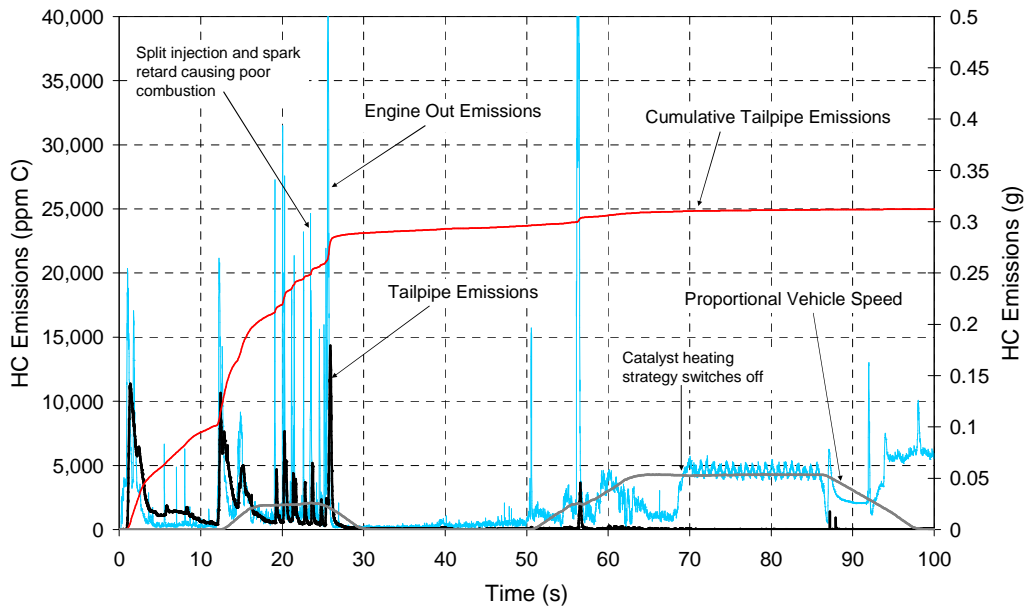


Figure 1: First 100s of New European Drive Cycle showing HC emissions

From the cumulative tailpipe HC emissions, it is clear that the catalyst is very active after the 1st 60s of engine operation and that the main contribution to the tailpipe emissions comes from the initial transients (up to about 30s).

So engineers and calibrators are interested in studying this short portion of the drive cycle in some detail to minimise the HC emissions which emerge from the tailpipe.