

Heavy Duty Diesel NOx and EGR control

Introduction

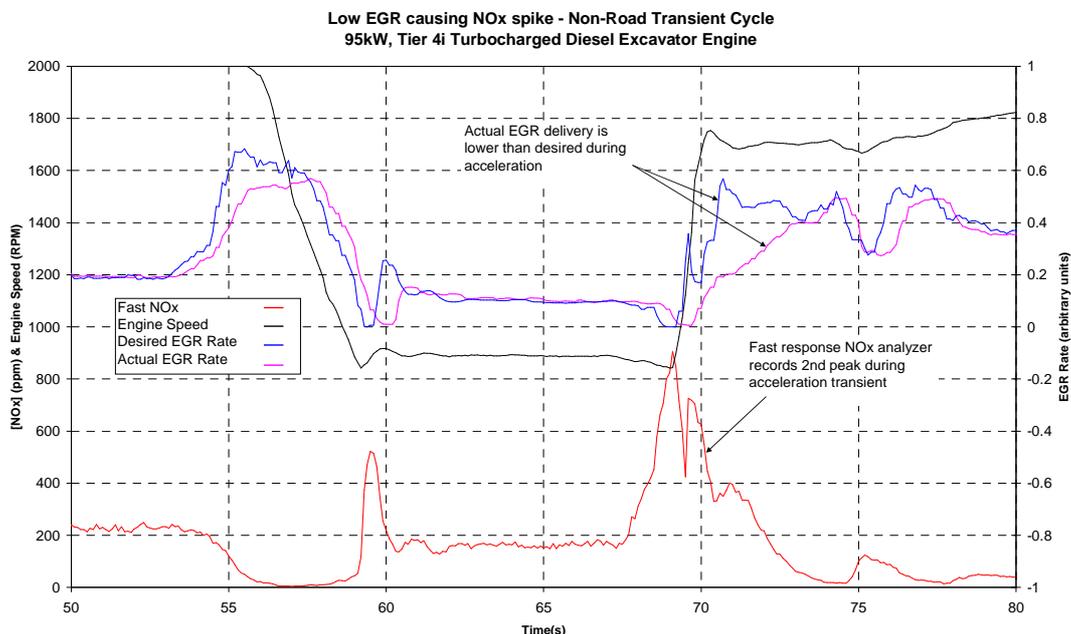
Engine-out NOx emissions can be controlled using Exhaust Gas Recirculation (EGR). During rapid engine transients, the EGR delivery has to be accurately calibrated yet the delivery of the desired EGR rate can be compromised because of valve hardware response or reliability problems. Measurement of the actual engine-out NOx emissions in real time can detect transient “spikes” of NOx caused by errors in EGR delivery (or other control problems).

Experiment

In this experiment the CLD500 was used to measure engine-out NOx in a Tier 4i 95kW turbo-charged diesel engine for off-road applications. The engine was driven by a dynamometer on a Non-Road Transient Cycle (NRTC) and the results are presented with EGR recorded on the same timescale.

Various other engine parameters were logged simultaneously.

Results



The figure above shows one of the many accelerations within this (highly transient) test cycle. The desired and actual EGR rates are plotted; the EGR rate was calculated from the measured valve opening position and differential pressure.

Between 70s and 75s there appears to be a lower EGR rate than desired. This occurs at the same time as a 2nd peak of NOx is produced by the engine (which is not visible as a distinct entity when viewed with a standard bench NOx analyser). The same effect was repeated many times during the entire NRTC.

If the actual EGR rate were closer to the desired rate, this NOx spike would be significantly reduced.

Conclusions

Fast measurement of engine-out NOx transients allows calibrators and researchers to “zoom-in” to problem areas and discover possible reasons for high emissions. In this case, poor EGR delivery is the likely cause of part of an acceleration NOx peak.