Factsheet: Euro 6d-temp/6d car emissions

May 2020

Data on pollution from 6d-temp diesels:

Euro 6d-temp diesels still do not respect emissions limits when driven outside of RDE test boundaries

1. Three 6d-temp diesel cars RDE tested by the European Commission's Joint Research Center in 2019[1] exceeded the NOx emission limit when driven more dynamically then allowed by the RDE regulation, emitting between 189-338 mg/km. (Exceeding the 80 mg/km limit by 2.3-4.2 times or 1.13-2 when CF of 2.1 is applied).
    a. The Peugeot 308 tested by the JRC emitted 25 $x10^{11}$/km PN during urban up-hill driving (outside of RDE conditions) exceeding the emission limit ($6x10^{11}$/km) by over 4 times or 2.8 times when a CF of 1.5 applied.
2. Testing by ADAC[2] showed that a Volvo XC60 6d-temp diesel emitted 239 mg/km (2.9 times limit, 1.4 times with CF of 2.1) when driven faster than allowed by the RDE regulation (typical of driving on the german autobahn. The vehicle also emitted 94 mg/km of NOx during the ADAC ecotest (not RDE compliant).
3. Testing conducted by T&E on a Euro 6d-temp Honda Civic[3] emitted measured NOx emissions in excess of 1400 mg/km driven outside of RDE conditions (more dynamically and with greater positive cumulative altitude gain).

Some Euro 6d-temp diesels only respect the emission limits on the road due to the use of CF.

4. One of the cars tested by the JRC[4], a Ford Focus emitted 119 mg/km of NOx during an RDE compliant test, in excess of the NOx emission limit if no CF is applied.
5. Testing of a Euro 6d-temp diesel by the VTT technical Research Center of Finland[5] showed that the NOx 80 mg/km NOx limit was exceeded on the road on all 3 RDE compliant tests with emissions of over 100 mg/km on all three tests (however all were below 168 mg/km limit when 2.1 CF applied).

[1] Suarez-Bertoa. R. et.al.. (2019) On-road emissions of passenger cars beyond the boundary conditions of the real driving emission test. Environmental Research.
[2] ADAC. (2019, 02, 21) Saubere Diesel: Abgasnorm Euro 6d-temp im test.
[3] T&E. (2018) Cars with engines: can they ever be clean?.
[4] Suarez-Bertoa. R. et.al.. (2019) On-road emissions of passenger cars beyond the boundary conditions of the real driving emission test. Environmental Research.
[5] VTT. (2019) Euro 6 diesel passenger cars' emissions field tests.

Emission limits are not respected by some diesel 6d-temp cars on tests during which a diesel particle filter cleaning (regeneration) takes place due to a large increase in the amount of particles emitted due to the DPF regeneration.

6. Two Euro 6d-temp diesel cars (Opel/Vauxhall Astra and Nissan Qashqai) tested by T&E[6] exceeded the PN emission limit by 32-115% on RDE tests during which a DPF regeneration took place.

Data on pollution from 6d-temp petrol cars:

Some Euro 6d-temp petrol cars still do not respect emissions limits when driven outside of RDE test boundaries

7. Testing conducted by T&E on a Euro 6d-temp Ford Fiesta[7] measured PN emissions in excess of 2.2 x10^{12}/km (over 3.5 times legal limit, 2.4 times when CF of 1.5 applied) when driven outside of RDE conditions (more dynamically and with greater positive cumulative altitude gain).

Unregulated pollutants:

Many pollutants which are harmful to human health or the environment are emitted from ICE cars but currently unregulated, the two most important for the current discussion are:

Sub-23nm particles While all particles are harmful to human health, particles under 23nm which are currently neither measured of regulated in official tests could potentially be the most harmful due to the high efficiency with which they are deposited in the lungs[8] and their potentially higher toxicity.

8. The Down-to-ten project[9] has shown that for the vehicles tested the total amount of particles emitted from a diesel car with a DPF can increase by up to 3 times when particles down to 10nm are measured and for petrol cars with a GPF the increase can be up to 2.5 times (compared to > 23nm particles).
9. Testing by T&E of 2 Euro 6d-temp diesel cars[10] indicates that the total amount of particles of between 10-23nm in size can exceed the amount of larger than 23nm

[6] T&E. (2020) New diesels, new problems.
[7] T&E. (2018) Cars with engines: can they ever be clean?.
[8] ICRP respiratory deposition model as presented by DownToTen. (2019) Particle emissions measurements on CNG vehicle focusing on, sub-23nm. TAP Conference 2019.
[9] DownToTen. Andersson. Jon. (2019, 06, 17th-20th) Update on syb-23nm exhaust particle number emissions using the DownToTen sampling and measurement systems. 23rd ETH Conference on combustion generated nanoparticles. Zurich.
[10] T&E. (2020) New diesels, new problems.

particles emitted, in some cases resulting in total particle emission increasing by up to 184 %.

Ammonia. Ammonia contributes to particle pollution; each 1mg of ammonia is estimated to contribute 1mg to particle air pollution smaller than 2.5 micrometer ($PM_{2.5}$)[11].

10. Testing by T&E showed[12] that some diesel 6d-temp cars can emit large amounts of ammonia, especially during DPF cleaning (regenerations) emitting up to 33 mg/km.

11. Testing by the JRC also shows that 6d-temp diesels can emit large amounts of ammonia, with especially high emissions during urban on road driving (of up to 32 mg/km)[13].

12. No data available for ammonia emissions of 6d-temp petrol vehicles but the JRC measured ammonia emissions of between 27-85 mg/km for a Euro 6c petrol car[14] during RDE tests.

[11] JRC. R. Suarez-Bertoa. (2019) Current non-regulated emissions in the EU. Integer Emissions Summit & AdBlue Conference. Munich.
[12] T&E. (2020) New diesels, new problems.
[13] Suarez- Bertoa. R. et.al. (2020) Regulated and non-regulated emissions from Euro 6 diesel gasoline and CNG vehicles under real-world driving conditions. *Atmosphere*.
[14] Suarez- Bertoa. R. et.al. (2020) Regulated and non-regulated emissions from Euro 6 diesel gasoline and CNG vehicles under real-world driving conditions. *Atmosphere*.