



Exhaust Gas Recirculation and Pig Pee in Diesel Engines

High on people's minds at the moment, and on the political agenda and on media coverage in general, is the concern about the impact our activities are having on the environment and on our personal health. With so much being said about plastic waste, pollution in cities, over use of fossil fuels, and many, many other issues it can really become too much for us to comprehend; too much for us to feel that we can do anything about it. However, as with many things, doing what little can do individually can have a significant collective impact. To that end, this brief article explains the importance of maintaining the emission systems fitted to our diesel cars and vans.

As always, the automotive industry, as a significant contributor to pollution in general and atmospheric pollution in particular, is working hard to reduce its impact. Advances over the years has been huge, thanks to many design and technological improvements. In this article we will be looking again exhaust gas pollution; specifically, Oxides of Nitrogen, and at the technologies used to reduce exhaust gas pollutants from diesel engines; specifically Exhaust Gas Recirculation (EGR) and urea injection (AdBlue).

The Problem - Oxides of Nitrogen

Actually, this is not the only pollutant gas emitted from engines, but it's the one we're specifically looking at here. Normally, Nitrogen will not combine with oxygen, but under the high temperature conditions of an engine's combustion chamber, nitric oxide (NO) and nitrogen dioxide (NO₂) are produced. These gasses are collectively known as NOx. It is the NO₂ which is particularly hazardous. It is calculated that road transport activity contributes around 40% of the total NOx across the EU. Within major cities, this contribution is greater and can be around 70%.

NOx has a negative effect on our health, leading to irritation of the airways, poorer lung function, increased response to allergens, and asthma. It also leads to the formation of particulate matter and ground level ozone which are both harmful to health.

NOx also affects the environment, reducing plant growth, causing acid rain and smog.

The Solution

As stated above, Nitrogen does not readily oxidize, but in the high temperature and pressure of the combustion chamber, NO and NO₂ are produced. EGR has been used for many years (since 1970s and earlier) but has been common since the late 1980s. The introduction of Euro 3 emission regulations (2000) and Euro 4 (2005) required more sophisticated electronically controlled, cooled EGR and a reduction catalyst to reduce NOx emissions from 1992 Euro 1 levels (0.97g/km), to 2005 Euro 4 levels (0.25g/km).

Euro 5 in 2011 saw the introduction of the Diesel Particulate Filter (DPF) and reduction of NOx to 0.18g/km, amongst other requirements.



Euro 6 requires further reduced NOx emissions; down to 0.08g/km which requires the addition of the AdBlue system and Selective Catalytic Reduction technology (SRC).

EGR - how it works

An electronically controlled valve allows a controlled amount of exhaust gas to pass through a pipe, back into the inlet side of the engine to mix with the fresh charge of air entering the engine cylinders. This has the effect of reducing the amount of oxygen in the cylinder and helping to absorb heat, thereby reducing combustion temperature and reducing the production of NOx. There are also negative effects of slightly reduced efficiency and an increase in engine wear.



AdBlue - how it works

AdBlue has no effect on the engine itself. It is an exhaust gas after treatment which injects a small amount of urea solution ($\text{CH}_4\text{N}_2\text{O}$) into the exhaust flow. The urea changes to ammonia (NH_3) and carbon dioxide CO_2 in the heat of the exhaust and is fed into the Selective Catalytic Reduction (SCR) catalytic converter where the NOx is converted into Nitrogen and water.



So is AdBlue made from Pig pee? NO! No it's not. It's manufactured from ammonia and CO_2 to produce very pure urea ($\text{CH}_4\text{N}_2\text{O}$) which is then mixed with pure water.



Why you shouldn't use remapping to remove your EGR or Adblue

First of all, it would mean your car or van no longer complies with Construction and Use Regulations*. Basically, this requires that any emission reduction technology fitted to a vehicle should not be removed.

Secondly, the EGR valve is referenced during the regeneration cycles of the DPF. Blanking and/or deleting the EGR will lead to premature failure of the DPF. On some systems, this failure can occur very soon after blanking the EGR.

Thirdly, and more fundamentally important, removing these systems will increase emission of Nitric Oxide and Nitrogen Dioxide. Nitrogen Dioxide in particular leads to the health and environmental problems mentioned above, and more. It is estimated that the effects of NO_2 on mortality are equivalent to 23,500 deaths annually in the UK.** We cannot be party to any activity which further exacerbates these statistics, or frustrates their reduction.

In conclusion

So while we may carp at our DPF, EGR and AdBlue systems, especially when something goes expensively wrong, consider the even greater cost of removing these systems. They are not simply the product of some over zealous bureaucrats in Brussels. They are a necessary part of the growing system of measures which protect our health environment from the even faster growing impact of our growing technological societies

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remapping your vehicle**

*It is an offence under the Road Vehicles (Construction and Use) Regulations (Regulation 61a(3)1 to use on the road, a vehicle which no longer complies with the air pollutant emissions standards it was designed to meet.

**Defra analysis using interim recommendations from COMEAP's working group on NO_2 . The working group made an interim recommendation for a coefficient to reflect the relationship between mortality and NO_2 concentrations (per $\mu\text{g}/\text{m}^3$). COMEAP has not yet made any estimates of the effects of NO_2 on mortality. Any analysis will be subject to change following further analysis by the working group and consultation with the full committee.