

## Written evidence submitted by Mr Martin Maynard (VTA0035)

### Evidence from M H Maynard to the Transport Committee Inquiry into Vehicle Emissions and EMIS (Emissions Measurement in the Automotive Sector) Inquiry

This information is provided by Martyn Maynard, retired engineer and owner of VW Passat TDi

#### Dieselgate:- How it could have been avoided

If you have followed the issue in the press, you will probably believe that the primary motive for adjusting NOx emissions whilst outside the test environment was to improve performance and fuel consumption on the road. In my opinion, this is not the case. The primary motives (which probably apply to all EU car manufacturers), appear to be far more subtle, and far more dangerous. Furthermore, it looks like Dieselgate could not have happened without the agreement, cooperation or gross negligence of EC legislators.

Of course, this is just my opinion and I'm by no way an expert on any of the technical areas. However in my opinion all the evidence I see points to one thing. I would be most grateful if you could investigate my concerns and either tell me I'm wrong or take some decisive action:-

**Car manufacturers were unable to simultaneously and reliably achieve the EU legislated levels of NOx and Diesel Particulates (soot) whilst cars were being driven on the road in relevant ambient conditions. The "motoring establishment" knew this but instead of confronting the problem head on they set off on a disastrous path.**

The technical challenge, in general terms, all other thing being equal, was that:-

- Reducing NOx from the engine, increases soot from the engine, which damages the diesel particulate filter.
- Increasing NOx from the engine, reduces soot from the engine, improves the life of the diesel particulate filter, but damages the atmosphere.
- I believe the choice was stark. Vehicle Reliability or Environmental Pollution. It looks like Car Manufacturers and EC legislators chose vehicle reliability over the environment.
- As a result, for the majority of the time, whilst on the road, it appears that all European car manufacturers employ strategies that vastly increase the NOx emissions, in order to reduce the soot load on the Diesel Particulate Filter and prolong its life.

There is plenty of circumstantial evidence that appears to support the above conjecture (ref1). Probably the most damning indication that this debacle was caused by lax and ineffectual legislation, is contained within the EU directives and legislations. For example, if you compare the legislations for cars (light vehicles) and buses/trucks (heavy vehicles) you will find:-

- The legislation for cars contains numerous potential loopholes, which may allow vehicle manufacturers to:-
  - Switch off NOx emissions controls to protect the engine (and so extend the life of the Diesel Particulate Filter) and spew NOx into the atmosphere. (ref 2)

- Avoid submitting evidence regarding the durability and continued emissions performance of the Diesel Particulate Filter.(ref 3)
- The legislation for buses and trucks is far more precise, prescriptive and specifically avoids the use of such devious practices (ref 4). As a result, it appears that Buses and Trucks:
  - Achieve the legislated level of emissions on the road under most operating conditions and temperatures. (ref 5)
  - Achieve the legislated durability requirements for Diesel Particulate Filters.

The fact that the EC itself could simultaneously negotiate and issue similar documents, which have resulted in vastly different outcomes, is in itself a clear indication that there may be something very wrong at the heart of the EU legislative process. All the same technology and technical support were available. But somehow it appears that the legislators managed to come up with two very similar specifications, one that worked, and one that didn't. The legislators have known for years (ref 6) about the discrepancies in emissions. They didn't need to wait for development and introduction of PEMS before they removed the "loopholes".

Furthermore, it appears the legislation allows the car manufacturers to forgo legislated durability tests on emissions systems. Legislation provides and allows the use of standard degradation factors (ref 3). This begs the questions:-

- **What evidence did the EC legislators use to prove that the assigned degradation factors provided by the legislation are representative of the actual in service degradation of all manufacturers emissions control systems throughout the full 160,000 km test requirement?**
- **What evidence is now being used to prove that proposed changes to software (and the NOx reduction strategy) will not change actual in service emissions degradation factors?**

When the EU tried to break into the US market and the NOx problem was finally disclosed to the world, what did the legislators do? Did they confront the problem head on? Did they own up to their role and resolve the issue in the best interests of the commerce, climate, citizens and customers? No. It appears that they set off on the road of denials, misinformation red herrings half truths and cover-ups.

I have briefly examined the document: - Legal obligations relating to emission measurements in the EU automotive sector, which was issued in June 2016 (ref 6). I'm afraid this document does little to allay my fears. To me it just attempts to divert attention from the real issues i.e.:- For whatever reason, the EC issued lax legislation which was full of loopholes.

Before starting a course of changing procedures and introducing more complex regulation the EC needs to admit that the emissions scandal was encouraged (or caused) by lax legislation. In all probability manufacturers were emboldened by this lax legislation and exploited it to the full. The EC needs to understand why the legislators chose to issue such flawed documentation. There is plenty of evidence to indicate that "motoring establishment" knew that the legislation was weak, but they did nothing about it (ref 6). They just used delaying tactics and claimed that the solution to the problem will come in the next set of legislation. I'm afraid that if there is not

some sort of fundamental reform, the next set of legislation will be as full of loopholes as this set.

Now I am not an expert on any of the subjects discussed, and I am relying solely on documentation currently in the public domain. I am confident however that a truly independent subject matter expert would agree that the above require further investigating. If you produce evidence that disproves the above conjecture I am perfectly happy to admit that I am wrong. I will apologise, and I trust that you will accept that apology. If I am correct however, the EC legislators and car manufacturers need to admit what they have done and start building bridges.

*1 July 2016*

## REFERENCES

Note:- words in *“quotes and italics”* are extracted from the referenced documents.

### **Ref 1 Circumstantial Evidence that Manufacturers Increase NOx on the Road to Improve the Reliability of the Diesel Particulate Filter.**

- The primary method to control NOx (EU5 engines) is EGR. Accepted scientific evidence shows that increasing EGR rate (to reduce NOx emissions) increases Diesel Particulates into the DPF filter, reducing its reliability and durability.
- The DP filter needs to regenerate passively to maintain performance. The presence of NOx allows it to regenerate at lower exhaust temperatures (i.e. during shorter trips). Thus, reducing EGR rate (which increases NOx emissions) reduces diesel particulates into the DPF filter. It also enables those diesel particulates trapped in the filter to be burnt more effectively by passive regeneration at a lower temperature. These effects significantly improve DPF life and reliability.
- The EU specification says that emission controls can be disabled to prevent damage to the engine. Lower EGR rates reduce soot and increase NOx from the engine. This improves the reliability and durability of the DPF.
- Manufacturers say they reduce EGR rates (and hence increase NOx emissions) to prevent damage to the engine. I believe they also do it to improve DPF life and reliability.
- There is already history of problems with the diesel particulate filter on cars. A whole industry has sprung up replacing, repairing, deactivating and removing them. Increasing EGR rate would reduce NOx, but increase diesel particulate emissions into the filter, making an already fragile situation worse.
- Manufacturers' web sites say that if you do primarily short journeys, you probably shouldn't buy a diesel.
- DPF is not normally covered by warranty.
- The EC specification requires an emissions system durability test to be passed. However manufacturers normally choose to use assigned degradation factors (allowed by and included in the specification) to avoid carrying out this test. The JRC has questioned this practice. The EC
- EC legislators need to provide proof that the factors are representative and won't change due to proposed software upgrades.

- I have asked manufacturers what tests they have done to ensure that the proposed software fix (to reduce NOx) will not degrade DPF reliability and maintainability. They will not unambiguously answer my questions.
- When discussing the software fix, the KBA talk about not affecting performance and fuel consumption and noise. They say nothing about reliability.
- I have 2 friends who have had serious problems with DPF / EGR reliability. One had a brand new Toyota diesel. The other was an older Lexus with approx. 20,000 miles on the clock.
- Repairs are expensive, and not necessarily covered by warranty.
- Damage would not be noticed by everyone immediately. Drivers affected first would be those doing primarily short journeys. Others may not find out for many thousands of miles, when the DPF needs replacing at vast expense (well before the rest of the vehicle has achieved its useful life). How would anyone know that the damage had been caused by the proposed software changes?

### **Ref 2 REGULATION (EC) No 715/2007 Emissions from Light Passenger and Commercial Vehicles (Euro 5 and Euro 6)**

*“The use of defeat devices that reduce the effectiveness of emission control systems shall be prohibited. The prohibition shall not apply where...the need for the device is justified in terms of protecting the engine against damage or accident and for safe operation of the vehicle.”*

### **Ref 3 JRC Science & Policy Report 2014:-Durability Demonstration Procedures of Emission Control Devices for Euro 6 Vehicles.**

JRC Science & Policy Report 2014:-Durability Demonstration Procedures of Emission Control Devices for Euro 6 Vehicles.

*“.....the accelerated ageing procedure for CI vehicles was included in the Euro 5 legislation in a late phase of its development process and upon a proposal of the automotive industry. At the time this procedure was very little discussed among the stakeholders and was not supported by robust validation data.”*

*“In Europe, the use of the assigned deterioration factors is by far the most preferred option by the car manufacturers. The reasons of that are quite obvious: lower costs and reduced time for the type approval of vehicles.”*

### **Ref 4 REGULATION (EC) No 595/2009 Emissions from Heavy Duty Vehicles (Euro VI)**

*“defeat strategy’ means an emission control strategy that reduces the effectiveness of the emission controls under ambient or engine operating conditions encountered either during normal vehicle operation or outside the type-approval test procedures”*

*“The use of defeat strategies that reduce the effectiveness of emission control equipment shall be prohibited.”*

### **Ref 5 TOI Report 1407/2015 Emissions from New Vehicles - Trustworthy?**

*“Based on measurements of 12 heavy vehicles with new Euro VI approved engines and seven Euro 6 approved cars with diesel engines, it is possible to draw two clear conclusions when it*

comes to exhaust emissions:

- All the tested heavy vehicles with Euro VI engines have very low emissions of NO<sub>x</sub> and PM in real traffic. The tested NO<sub>x</sub> and PM emissions were less than 1/10 of that from previous generations of city buses and other heavy vehicles with Euro VI engines, more or less regardless of the driving cycle used when testing.
- Euro 6 type approved private cars with diesel engines have 4-20 times higher emission of NO<sub>x</sub> in city traffic and during cold weather than the type approval limit value (0,08 g/km), see Figure S2. The average emission of NO<sub>x</sub> from the tested Euro 6 private cars with diesel engines was also about four times higher than the average emission from the tested city buses and heavy vehicles with Euro VI engines.”

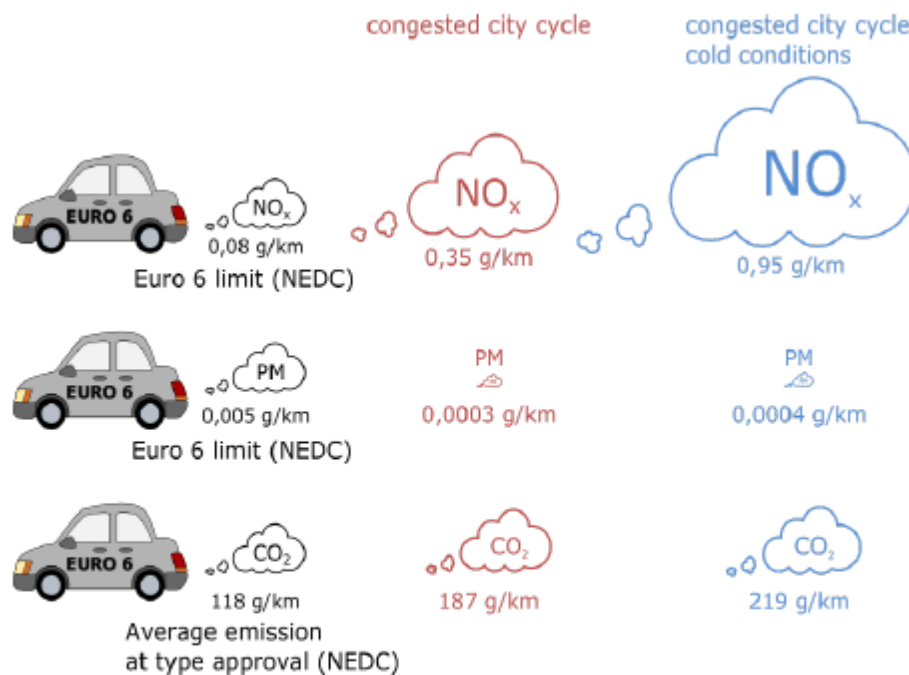


Figure S2: Comparison between limit values from EU's type approval regulations (black clouds) to emissions in "real life" city traffic from the average Euro 6 diesel passenger car. NO<sub>x</sub>, PM and CO<sub>2</sub> emission when using the Helsinki city cycle. Measured at +23 °C (red clouds) and -7 °C (blue clouds). The size of the red and blue clouds indicate the difference in emission from the emission in the type approval test (NEDC).



Figure S1: New heavy vehicles with Euro VI approved diesel engines have very low emission of all types of local emissions. NO<sub>x</sub> emission from new passenger cars with Euro 6 diesel engines under demanding city-driving conditions is still a challenge for urban air quality. The emissions shown are typical for demanding city-driving for passenger cars and city-buses, respectively.

**Ref 6 Policy Department A, 29 June 2016:- Legal obligations relating to emission measurements in the EU automotive sector**

- Why does the report not include a detailed evaluation of the EU emissions standards for Heavy vehicles? If this were done, it would show that the definition and responsibilities relating to defeat devices (or strategies) are completely different. I believe that the report would conclude that the legislators knew that there were issues with the definition and implications of a defeat devices, **but chose not to address these issues** in regulations for light vehicles.
- The existence of a defeat device (legal or otherwise) is at the root of the current scandal, why is obvious error not identified and discussed? Why does the report make little mention of the legality or otherwise of “defeat devices” used by vehicle manufacturers (in particular those based on ambient temperature)?
- The heavy vehicle legislation includes terms like:-

*“engine operating conditions encountered either during normal vehicle operation or outside the type-approval test procedures”*

*“the requirements to effectively limit the tailpipe emissions under the range of ambient conditions under which the vehicle may be expected to operate, and under the range of operating conditions that may be encountered”*

*“Any engine system .....shall retain its emission control function during all conditions regularly pertaining in the territory of the Union...”*

Why are terms like these not used in the regulations for Light Vehicles? Why is this not investigated by the report?

- Why does the report not make any reference to COMMISSION DIRECTIVE 2001/27/EC? This document includes still more measures relating to emissions defeat strategies:-

*“Defeat device means a device which measures, senses or responds to operating variables (e.g. vehicle speed, engine speed, gear used, temperature, intake pressure or any other parameter) for the purpose of activating, modulating, delaying or deactivating the operation of any component or function of the emission control system such that the effectiveness of the emission control system is reduced under condition encountered during normal vehicle use unless the use of such a device is substantially included in the applied emission certification test procedures.”*

*“Auxiliary control device means a system, function or control strategy installed to an engine or on a vehicle that is used to protect the engine and/or its ancillary equipment*

*against operating conditions that could result in damage or failure, or is used to facilitate engine starting. An auxiliary control device may also be a strategy or measure that has been satisfactorily demonstrated not to be a defeat device"*

*"Irrational emission control strategy means any strategy or measure that, when the vehicle is operated under normal conditions of use, reduces the effectiveness of the emission control system to a level below that expected on the applicable emission test procedures."*

It looks to me like the legislators were fully aware of the dangers of a defeat device 15 years ago, and were busy amending legislation to remove loop holes. For some reason this knowledge has not found its way into current legislation. But when defeat devices are discovered, everybody looks surprised. How can this be? Why are there no conclusions or recommendations regarding this in the report?

- The report quotes from the current light vehicle legislation:- *"In addition, the manufacturer must provide the approval authority with information on the operating strategy of the exhaust gas recirculation system (EGR), including its functioning at low temperatures. This information must also include a description of any effects on emissions."*

As noted in the report, the legislators have known for years about the discrepancy between real world and NEDC emissions. This discrepancy applies to vehicles approved by all Type Approval Authorities and is clearly a "global" issue that must be addressed at the highest level. Why, before setting off on a costly and protracted investigation did someone not just ask for the above information? Or, did the legislators already know the answer? Why does the report not ask these questions?

- As regarding durability, the report states:-  
*"The Regulation further regulates the durability of pollution control devices. It states that durability testing of pollution control devices undertaken in the scope of type approval must cover a distance of 160 000 kilometres (km) and the OEM should have the possibility of resorting to test bench ageing10 (Art. 4.2)."*

However why is the following crucial information buried in a foot note? :-

*"Alternatively to the ageing test on the test bench it is allowed to make usage of assigned deterioration factors."*

As noted in ref 2 this seemingly innocuous foot note is of great concern to the SRC. It allows manufacturers to avoid carrying out or declaring any durability tests on the emissions system and the vehicle as a whole. Yet most manufactures say that the main reason for employing a so called "legal defeat devices" was to avoid damage to the engine! So the manufacturers admit that they have a problem with reliability, and the

legislation specifically lets them avoid testing durability! What is going on? Why is such an obvious “loop hole” buried in a foot note? Could it be because the legislators knew what was going on and what the results of carrying out a test would be? Why is this not discussed in the report?

- Why didn't the legislators act earlier? Why are they placing so much emphasis on the next generation of legislation (with PEMS) when they have known about the emissions discrepancies for years?

*“Initial studies on the discrepancy of NOx emissions produced by vehicles were published from 2000 onwards, including the study on the emission behaviour of heavy-duty vehicles. In other words, this discrepancy in vehicle emissions was certainly known in the community of experts. Even if the EC is not sufficiently staffed with technical experts on vehicle emission measurements, at least the results of the ARTEMIS project – with participation of the EC – must have been known.”*

Why is potential act of negligence not discussed in detail?

- CONCLUSION AND POLICY RECOMMENDATIONS *“This chapter describes the most important conclusions and recommendations based on the findings of this study, including the stakeholder consultation (see chapter 4) and other related studies.”*

The report raises many valid points, however why does it not at least discuss the possibility, that this whole affair could have been stopped in its tracks years ago. Perhaps all the organisation responsible for overseeing the whole process needed to do, was undertake some simple investigation, ask some simple questions and follow through?

The report proposes many procedural changes (in particular with respect of measuring real world emissions), but it doesn't say that the discrepancy between real world and NEDC emissions was known for years by the legislators (see para 6.6 of the report). And yet they continued to issue sloppy legislation. In all probability, the existence of “loopholes”, emboldened the car manufactures and encouraged them to continue with their devious practices.