

#Dieselgate continues: new cheating techniques

How national investigations into emissions scandal are pointing to existence of new defeat devices

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A briefing by  TRANSPORT & ENVIRONMENT

Summary

With the main results of #Dieselgate investigations in Germany, France and the UK now published, one thing is clear: the scale of the abuses and the gap between test and real-world performance are worse than expected. Almost all of the cars tested emit much more pollution when tested in conditions (even slightly) diverging from the prescribed lab tests. Despite this European governments appear willing to “turn a blind eye” and not follow up with further detailed investigations or inquiries into how engines are calibrated and exhaust systems operate. Instead, carmakers are getting away with voluntary recalls while continuing to pump toxic fumes (NOx) into EU air, causing over 70,000 premature deaths each year.

The results indicate the presence of more defeat devices and show most manufacturers switch off or turn down their emission control technologies at temperatures and conditions outside of the lab test without rigorous justification. More suspiciously, most cars in Europe emit much more pollution after a hot engine restart compared to a cold one demanded by the EU law – in contrast to in the US.

A much more comprehensive investigation must now take place to force carmakers to come clean and require a revamp of emission strategies used. Stricter and clearer guidelines on the use of exemptions from the defeat device ban are equally necessary. But all this must be accompanied by a rigorous reform of the EU testing system which is in dire need of more independent checks on the road, oversight of national regulators, and transparency.

1. National investigations so far

The results of national investigations into vehicle emissions testing following the VW scandal have now been published in Germany¹, France² and the UK³. The investigations are screening exercises targeted at identifying models with anomalous emissions – the tests are not capable of demonstrating the presence of defeat devices, they only identify suspect vehicles.

The studies focused on identifying vehicles with defeat devices operating in a similar way to that used by VW, specifically using software to detect the presence of the test. The results indicate other manufacturers do not appear to pursue such a strategy and on this basis the reports give other manufacturers a clean bill of health. However, there are many types of defeat devices that can operate in a multitude of ways and the results indicate highly suspicious behavior in a number of respects:

1. Almost all cars tested do not meet the EU air pollution standards and generate much higher emissions when driven in conditions that are only slightly different from the official lab test specifications
2. When asked to explain high emissions on the road, manufacturers’ explanations indicate they switch off or significantly reduce the effectiveness of pollution control technologies in most driving

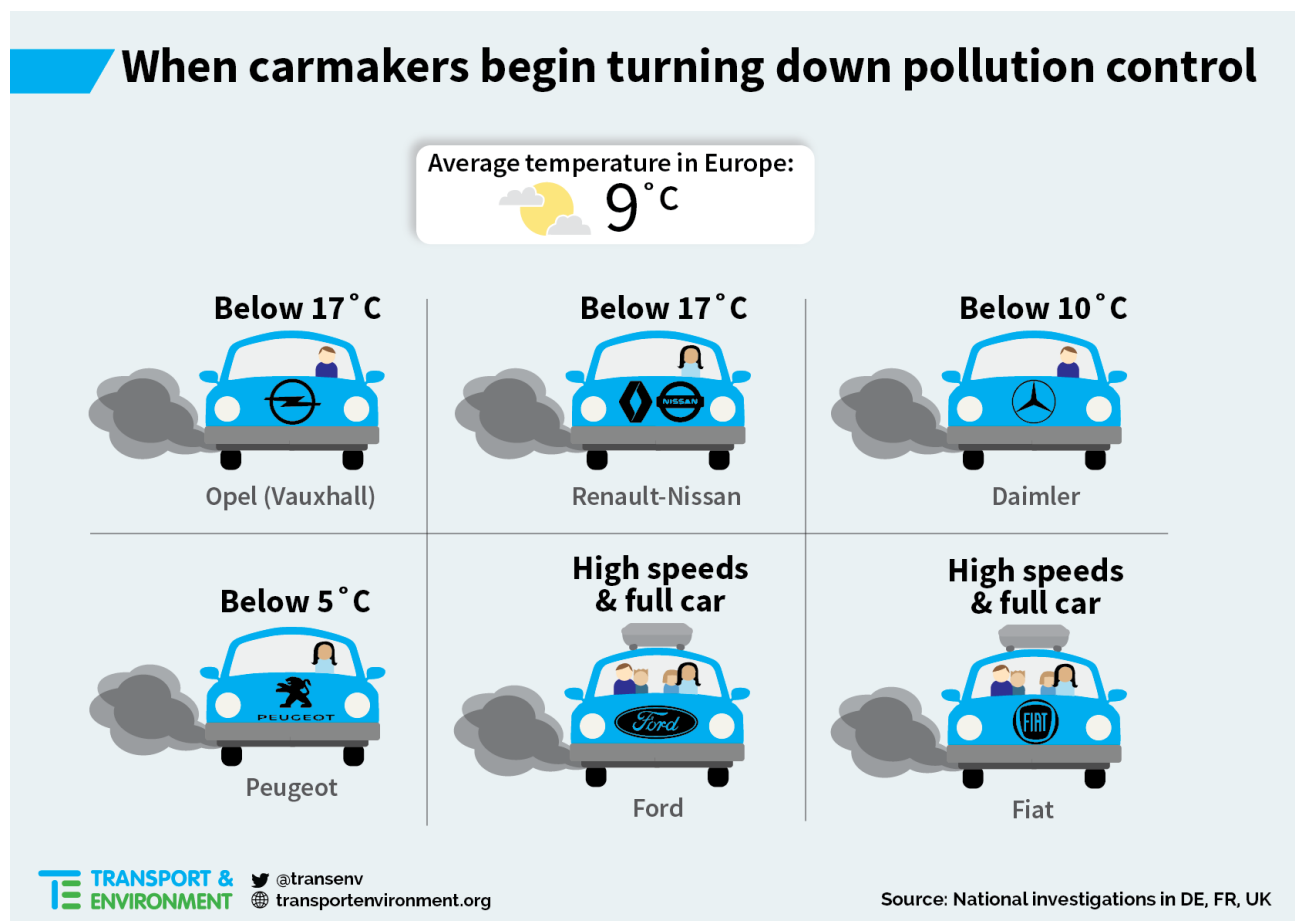
¹ http://www.autoevolution.com/pdf/news_attachments/630000-diesel-cars-of-german-origin-to-be-recalled-in-europe-more-to-follow-106820.pdf

² http://www.developpement-durable.gouv.fr/IMG/pdf/DP_Resultats_Commission_UTAC_le_27-04-2016.pdf

³ <https://www.gov.uk/government/news/government-publishes-findings-of-diesel-emissions-testing-programme>

conditions, including: low and high temperatures, high speeds, high altitudes, high engine loads (full car/luggage), etc. Such behavior utilises an extreme interpretation of EU rules on exemptions from the defeat device ban that is very suspicious and needs further investigation.

The image below summarises the conditions under which emission controls are idle for different manufacturers.



Below these temperatures the full effectiveness of exhaust systems is reduced. For example, while PSA's system is operational between -10°C and +60°C, it reaches 100% above 5°C.

Approval authorities appear embarrassed by the findings of their own inadequate regulation and rather than seeking to clean up the mess appear to wish to brush it under the carpet and simply accept manufacturers' justifications for the high emissions. The authorities do not wish to investigate further if the claim that the controls are needed to protect the engine are genuine. While action is being taken to bring carmakers to account in other parts of the world (US, Japan and South Korea), in Europe all recalls are voluntary and no enforcement action is being taken.

CARMAKERS ARE ACTING WITH IMPUNITY AND GOVERNMENT REGULATORY AUTHORITIES ARE UNWILLING TO HOLD THEM TO ACCOUNT. JUST AS CARMAKERS CANNOT SWITCH OFF BRAKING SYSTEMS TO PRESERVE THE LIFE OF BRAKING PADS, THEY SHOULDN'T SWITCH OFF AFTER-TREATMENT SYSTEMS THAT CONTROL POLLUTION IN MOST ROAD CONDITIONS IN EUROPE. THIS IS NOT A VICTIMLESS CRIME. 72,000 PEOPLE DIE PREMATURELY EVERY YEAR IN EUROPE, CHOKED WITH DIESEL FUMES.

2. What the law requires

Under EU law, defeat devices (defined as any sensor or equipment that senses different parameters to alter the operation of emission control systems) are banned apart from a few exemptions, including to protect the engine against damage and ensure safe operation.

This is what the law (Euro 6 Regulation, Article 5) says:

1. The manufacturer shall equip vehicles so that the components likely to affect emissions are designed, constructed and assembled so as to **enable the vehicle, in normal use, to comply with this Regulation** and its implementing measures.
2. The use of defeat devices that reduce the effectiveness of emission control systems shall be prohibited. The prohibition shall not apply where:
 - (a) the need for the device is justified in terms of protecting the engine against damage or accident and for safe operation of the vehicle;
 - (b) the device does not function beyond the requirements of engine starting;
 - (c) the conditions are substantially included in the test procedures for verifying evaporative emissions and average tailpipe emissions.

Its implementing measure 692/2008 further stipulates that:

“In addition, the manufacturer shall provide the approval authority with information on the operating strategy of the exhaust gas recirculation system (EGR), including **its functioning at low temperatures.**”

It is up to national type approval agencies to enforce the above ban and verify the legitimacy of the exemptions used. It is also their job to check the working of pollution control systems in different ambient temperatures. The current revelations seem to come as a surprise to all, including the regulators, indicating that they have failed to do their job properly (as none appears to have been aware of the way in which carmakers have been abusing the derogations).

Legal analysis undertaken by Geulen & Klinger⁴ of the Euro 6 derogations clearly states that:

1. Emission control systems should work in full effectiveness and in vehicles' normal use
2. The above derogations are justified in the case of absolute necessity to protect the engine from damage/accident, not for mere component protection and durability concerns as currently abused by carmakers
3. When it comes to safety, no-one would allow a switch-off device that reduces braking effectiveness or changes the door locking system under low outdoor temperatures – same applies to emissions legislation.

In the US, the ban is enforced in a much more comprehensive manner. First, it is the burden of manufacturers to prove why they need to use the exemptions and disclose upfront (together with technical justifications) what “legal” defeat devices they use. Second, the authorities (US EPA) have clear powers to approve or reject the use of exemptions and penalise manufacturers for false claims. Third, there is extensive technical guidelines on which to base the decisions – taking into account best available techniques, effect on emissions and various weather and engine conditions.

While the EU law can be strengthened, carmakers are cheating under the current rules; and the national regulators – colluding with the industry – are failing to enforce those rules properly.

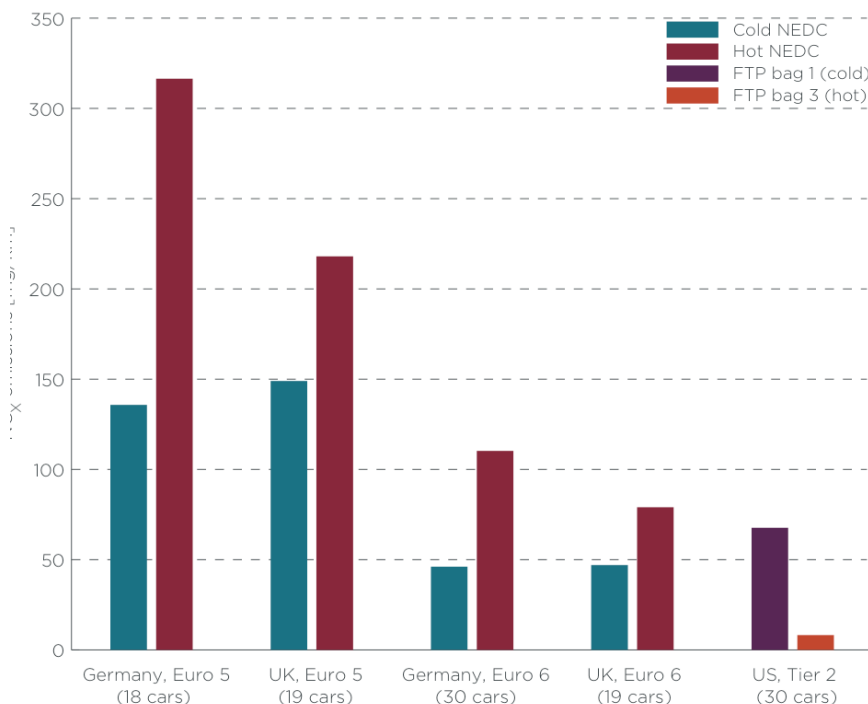
⁴ Geulen & Klinger, *Legal opinion on whether it is allowable to use switch-off devices in the emission control systems of passenger cars*, compiled on behalf of the environmental body Deutsche Umwelthilfe, 22 March 2016

3. More defeat devices

Detailed consideration of the test results shows authorities are ignoring the likely presence of other types of defeat devices. First, a **“thermal window” defeat device** has emerged. Manufacturers claim that they have to switch off one of the main pollution control technologies – Exhaust Gas Recirculation, EGR – in low ambient temperatures due to associated risks of condensation and/or build-up of soot. The excuse simply doesn’t stand closer engineering scrutiny because ambient temperature has only a small effect on condensation once the engine is warm. Intake air used for EGR (to lower combustion temperature and thus engine-out NOx emissions) is influenced by many factors, including engine temperature, the turbocharger and exhaust gas temperature itself. All of these parameters can be correctly calibrated to limit the associated risks and ensure that EGR works properly in wider ambient conditions – 5 of the 38 tested vehicles did have emissions below regulatory limits including at 10°C. And similar diesel engines are already calibrated accordingly in the US, where the US EPA only allows reducing EGR at temperatures below -4°C. The very fact that some carmakers switch EGR off at 17°C, some at 10°C and some at 5°C clearly demonstrates the refusal of industry to apply best available technology in Europe where rules are much weaker and national regulators compromised. After testing by the French government, Renault has agreed to voluntarily extend the operating range for full functioning of its EGR system to between 5°C and 40°C. Renault had been reducing EGR operation below 17°C and above 35°C. The change essentially doubles the ambient-temperature range of full operation, and suggests that engine calibration can be modified to continue full EGR down to at least 5°C. If this is so simple why is it not required? Why is it being done voluntarily? Why are there no penalties?

Conveniently, the EU lab test (NEDC) is done at temperatures between 23°C and 29°C so all car models pass that. But once the vehicle is on the road, temperature sensors are enabled to switch off anti-pollution control without any solid engineering justification. This is clearly not allowed by the Euro 6 regulations

Secondly the test shows the presence of a **“hot restart” defeat device**. All of the national testing results⁵ show much higher emissions after a hot engine restart, despite repeating exactly the same EU lab test (in EU law a cold start is mandated). But manufacturers’ explanation is “bogus”⁶ as the emissions generated



are both a function of the combustion and effectiveness of the after-treatment that should be much better when hot. While full EGR capacity cannot be used with a cold engine, it works well with a warm one thus reducing NOx more effectively. Secondly, other NOx after-treatment – such as NOx traps or Selective Catalytic Reduction – are also ineffective at cold starts but most efficient at high engine temperatures. From an engineering point of view, a hot engine restart should produce less emissions, not more – something clearly seen from the US testing data obtained by ICCT from the EPA;⁷ as illustrated.

The US test includes a warm engine restart, while the NEDC in Europe does

⁵ Apart from the French investigation which did not include a hot restart test

⁶ <http://www.theicct.org/blogs/staff/emissions-test-defeat-device-problem-europe-not-about-vw>

⁷ Ibid.

not. So manufacturers calibrate their engines to only pass the test – from a cold start – and not to work in other conditions when on the road. They know very well that EU authorities ignore emissions after a warm engine restarts – for example, a second trip undertaken shortly after the first. These represent the majority of engine starts in Europe and therefore account for a large share of the high emissions.

Opel in particular has been in the spotlight,⁸ accused of switching off its emission control technology in most driving conditions such as high speeds, high loads and temperatures below 17°C. The tests carried out by DUH in Germany also show a clear presence of the hot restart defeat device in Opel Zafira (on the right, the same three tests were repeated twice – with two wheels rolling as on the EU test cycle and with four as normal).

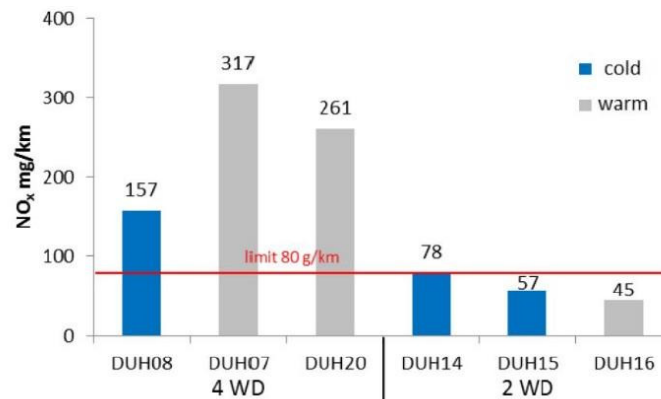


Fig. 5: Results of the NEDC (raw results without deterioration factor)

There is no engineering justification to switch off emission control technology based solely on low ambient temperatures, just as there is no justified reason for systematically higher NO_x emissions after a hot engine restart. While different from the defeat devices used by VW, these strategies deployed by the majority of manufacturers in Europe – Opel, Renault, Daimler, Ford, Fiat and others – constitute an unlawful misuse of the defeat device exemptions and lead to much higher emissions on the road compared to those measured in the lab tests. Both are illegal defeat strategies. Manufacturers’ claims they do not have “illegal software” are merely seeking to cover up illegal engine and after-treatment calibrations.

In May 2016 allegations of a third defeat device came to light. It was reported that several tests by the German type approval authority had found evidence that the exhaust treatment system in some Fiat models would **switch itself off after 22 minutes**.⁹ Emissions tests normally run for around 20 minutes.

4. Where Europe goes from here

The current national testing programmes have exposed the staggeringly high emissions from most new (Euro 6) diesel cars. They show carmakers are unable or unwilling to calibrate the engines and after-treatment systems of these cars to produce low emissions. They dispel the myth of “Clean Diesel”. The current situation in which most cars do not operate their anti-pollution systems in a wide variety of real-world conditions outside of the lab tests is clearly not compliant with the regulations.¹⁰ And yet national agencies seem incapable or unwilling to take action. There are two explanations:

1. Some national regulators are acting in the interests of national carmakers
2. Other regulators are fearful of losing the significant fees earned from carmakers for their approvals

It is clear the current high emissions and the Dieselgate scandal would have been avoided if the national regulators did their job properly. Instead carmakers have been allowed to ignore European air quality standards and get away with not using the well-established technology used in other markets and applications to reduce emissions.

⁸ <http://europe.autonews.com/article/20160518/ANE/160519860/opel-admits-using-shut-off-device-german-minister-says?ccid=email-ane-daily>

⁹ <http://www.bild.de/bild-plus/geld/wirtschaft/abgas-skandal/auch-fiat-betruengt-mit-illegaler-software-45905214>

¹⁰ Geulen & Klinger, *Legal opinion on whether it is allowable to use switch-off devices in the emission control systems of passenger cars*, compiled on behalf of the environmental body Deutsche Umwelthilfe, 22 March 2016

Three things must follow:

1. Ministers responsible for Type Approval Authorities must announce further detailed investigations to examine if regulations have been breached. The current testing results should be scrutinised further and followed by a much **wider testing exercise** to dig deeper and **unveil all types of defeat strategies** applied by carmakers to cheat the emissions tests. All manufacturers must be forced to come clean, type approvals withdrawn where necessary and mandatory recalls to redesign emission systems initiated. Penalties must be issued for those found in breach of the rules.
2. The current **rules around defeat device exemptions should be strengthened** by: a) requiring manufactures to disclose such strategies upfront at type approval; b) requiring national type approval agencies to examine and approve manufacturers' claims; and c) providing the authorities with clear engineering guidelines on which to base their approvals, as is done in the US.
3. The current **type approval procedure in Europe must be reformed**¹¹ and made more rigorous and transparent. EU oversight to ensure that national authorities do their work properly is urgently needed, as well as a comprehensive testing programme of vehicles in use. The current race to the bottom among national testing agencies must finally come to an end.

Further information

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¹¹ <https://www.transportenvironment.org/publications/type-approval-reform-once-decade-opportunity-improve-europe%E2%80%99s-failing-testing-system>