
DON'T BREATHE HERE
beware the invisible killer
Tackling air pollution from vehicles
September 2015
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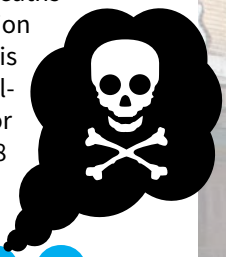
Legions of laws; half a million deaths

Urban air in much of Europe is not fit to breathe, and vehicles, especially diesel cars, are the principal cause. High levels of particles, nitrogen oxides and unburned fuel create a cocktail of harmful pollution that is breathed by almost every urban European citizen. The effects are half a million premature deaths each year; a quarter of a million hospital admissions; and 100 million lost working days cumulatively costing over €900 billion. The crisis is taking place despite extensive EU laws that limit ambient air-pollution levels, total national emissions, and emissions from major sources including vehicles. The Commission has acted against 18 EU member states for breaching pollution levels but progress to tackle the problem is glacial. EU limits for air pollution are projected to be breached for at least another 15 years and levels will remain above World Health Organisation no-effect guidelines.

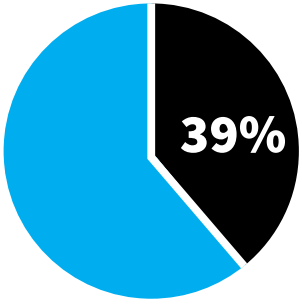


500,000

Premature deaths each year because of air pollution

Driving factors

Vehicles are the principal source of exposure because of their ubiquity and the proximity of the exhaust emissions to people. For example, vehicles produce 80% of the particulates and 46% of nitrogen oxides in London[1]. There has been some progress: lead has been removed from fuel; carbon monoxide levels have been reduced; and the introduction of Euro 6 limits on diesel cars is reducing primary particulate emissions. But nitrogen oxides (NOx) remain a key problem especially from diesel engines. These are converted in the air to toxic nitrogen dioxide and ultimately to secondary nitrate aerosol particles and to ozone (when combined with unburned fuel in the air). Particle emissions from older diesels and vehicles with damaged or illegally removed diesel particulate filters remain an issue. There are also problems with gasoline vehicles, notably particles from gasoline direct injection vehicles.

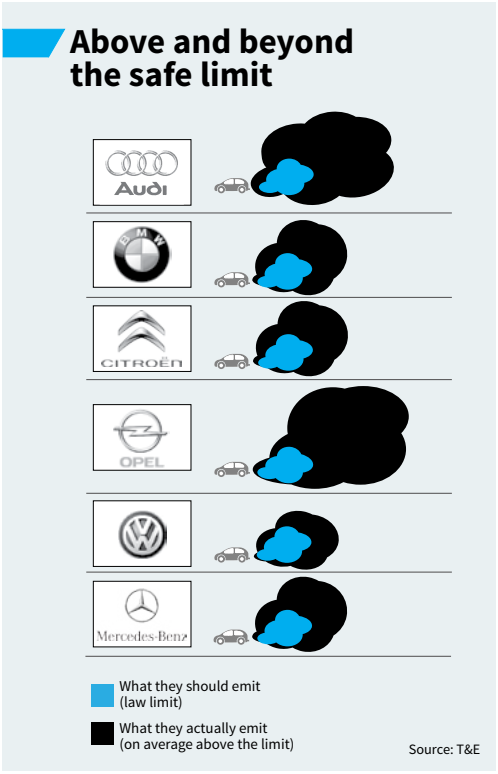


Transport share of NO_x in 2012

[1] Mayor of London, 2010, *Clearing the air: The Mayor's Air Quality Strategy*

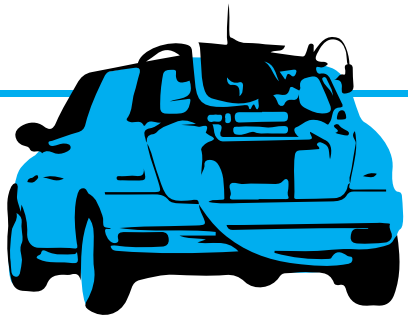
Test beating

The reason for the continuing high emissions from new cars is an ineffective system for testing vehicles that deliver impressive reductions of emissions in laboratory tests but fail to replicate this performance when driven on the road. This problem is extensive for diesel cars and vans that typically emit on average around **5 times more pollution** than permissible limits when driven on the road. But gasoline cars are not exempt – one in five modern petrol cars reportedly fail to achieve emissions limits on the road.[2] Laboratory tests are unrepresentative because the current EU test cycle (New European Drive Cycle, NEDC) is too slow and has insufficient acceleration. The test procedure contains loopholes the manufacturers exploit to get low results. Emissions are only optimised for the tested conditions and there is substantial anecdotal evidence that cars detect when they are tested and deploy "cycle beating" techniques to reduce emissions.



Reality check

Euro 6 regulations requiring cars to be tested under "normal driving conditions" were adopted in 2007 but the real-world driving emissions (RDE) tests in which portable emissions monitoring systems (PEMS) measure the actual pollution



[2] Emissions Analytics 2015, August 2015; *Air quality...it's hotting up*

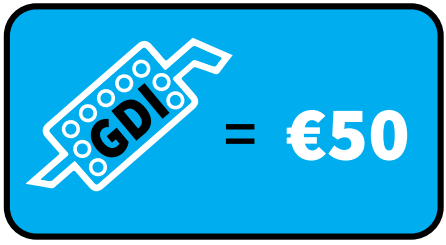
emitted from the exhaust have still not commenced. The test procedure has largely been finalised but there remain important omissions such as failing to account for higher emissions when the engine is cold or when the diesel particulate filter regenerates (cleans itself). Furthermore, agreement must still be reached on when and which 'not-to-exceed' limits (calculated using 'conformity factors') will apply. The test will also initially only apply to diesel NOx emissions yet these are not the only issue.

Quick turnaround

How long urban air pollution remains a health issue will largely be determined by how effective the new Euro 6 limits and RDE tests are. With full implemention by 2019, non-compliance with NO2 limit values will be virtually eliminated by 2025. In contrast a later introduction of a weaker limit (through high CFs) will lead to more than 10% of monitoring stations continuing to breach current limits in 2030.

Filters play their part(icles)

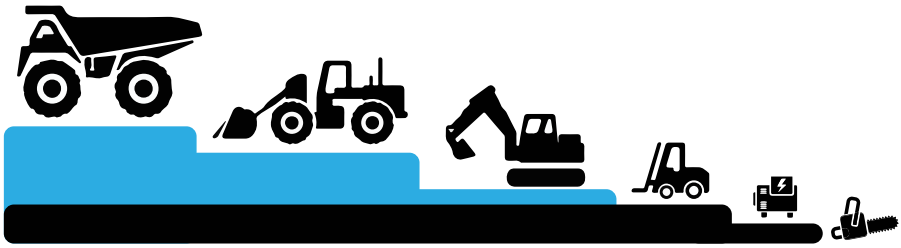
There is no technical reason why limits could not be met quickly and urban air pollution rapidly improved. Technology to control emissions is available and affordable. To tackle primary particle emissions a diesel particulate filter (DPF) is now used and is effective – although there are concerns about the impacts of regeneration, especially in urban areas. A similar but simpler gasoline particulate filter could tackle the high particle emissions from gasoline direct injection engines – but because limits are not enforced in real-world tests carmakers haven't fitted them despite their low cost (around €50). Selective Catalytic Reduction (SCR) tackles the diesel NOx issues in combination with other after-treatment systems. But a majority of modern cars continue to use cheaper, ineffective systems to avoid the approximate €200-500 cost of the system. Even where carmakers fit SCR they often configure the system to be ineffective to avoid either needing a large storage reservoir or requiring the driver to refill between service internals. This is because the reagent used in SCR systems (urea) is consumed and requires replacement. By systematically under-dosing with urea, a small bottle of urea can last a year – but the emissions are unnecessarily high.



Off-road: miles to go

Cars are not the only issue; Non-Road Mobile Machinery (NRMM), ranging from portable machines like hedge trimmers to large off-road construction machines like bulldozers and engines for compressors, pumps and generators, emit around **15% of urban NOx and 5% of particles.**

The rules governing their emissions are less strict than for Euro VI trucks and currently omit particle numbers. Tests are often unrepresentative of different use patterns in this very varied sector. The European Commissions has proposed Stage V emissions regulations to address some of these issues and they contain many positive proposals. But the proposed limits fail to align NRMM emissions with those of Euro VI trucks or require the latest abatement technology. The regulation is not technology or sector-neutral with higher limits for gas engines; there are important omissions such as particulate controls on locomotives, smaller barges and large generators. The proposed reforms to testing are also too limited and should be extended to checking in-service emissions using PEMS systems.



Going the extra mile: limit and checks

The introduction of RDE tests is a key step in tackling vehicle emissions. But tackling the air pollution crisis quickly necessitates not-to-exceed limits to be introduced from 2017 and Euro 6 limits to fully apply two years later. The test must also address the full range of driving conditions and measure emissions from all regulated pollutants from diesels and gasoline vehicles. The emissions checks performed as part of type approval on pre-production cars must be validated by a greatly expanded programme of conformity checks to confirm vehicles sold to consumers also meet these limits and prevent carmakers optimising type approval tests. More in-service conformity checks to confirm pollution abatement equipment continues to operate effectively throughout its lifetime – as successfully undertaken in the US – are also needed and the data should be routinely published.

Independent assessment

The Commission must also bring an end to the system in which carmakers select the bodies to test and check their compliance with limits and replace it with a truly independent European type approval authority. This could be funded by manufacturers paying a levy on each new car sold that would be used to finance independent testing. The system of checking that cars continue to meet acceptable pollution limits (Periodic Technical Inspections) is also out-dated, insufficient and in urgent need of improvement. This would ensure that SCR and particle filters function correctly throughout the life of the vehicle. In particular, PTI could be strengthened by setting an expiration date for the type approval certificate. This would ensure that older, more polluting vehicles get scrapped or used to a very limited extent beyond a given age. The Commission must also bring forward proposals for Euro 7/VII emissions limits to end the systems of different limits for diesel, gasoline and natural gas cars and to ensure WHO health guideline limits are met in heavily trafficked locations throughout Europe. Ambitious Euro 5 standards for motorcycles and scooters should equally be agreed to reduce emissions from this sector and promote use of electric two-wheelers.

The home front

This required future work programme of the Commission would address much of current crisis but member states must take complementary actions. Diesel taxes should be raised to be equivalent with those of gasoline on the basis of their energy content. This would begin to shift the market in favour of less polluting gasoline, hybrid and ultimately electric cars. CO2–based vehicle taxes should also include an adjustment to account for higher diesel air pollution emissions. Incentives could also be introduced to encourage the supply of vehicles with emissions significantly below that of Euro 6. This includes supporting through tax schemes and infrastructure the market for electric vehicles that produce zero air pollution in cities. Funding should also be supplied for retrofit programmes to reduce the emissions of older heavy-duty vehicles and NRMMs. National governments should also support and encourage local measures to manage traffic or emissions in pollution hotspots such as: cleaning up municipal fleets; tackling emissions from buses and taxis; establishing pedestrian areas; placing restrictions on vehicular access for all or high-emitting vehicles through low emission zones; and establishing goods trans-shipment centres.

A good deal

We cannot choose where we breathe so we must stop cars polluting our city air. The technology to clean up vehicle and machinery exhausts is available and costs a few hundred euros. It is a small price compared to the nearly **€1 trillion spent annually in health care** and lost output and productivity. Cars with engines must be stopped from polluting our air or prevented from accessing our cities. Citizens deserve the right to clean air wherever we need to breathe.

Recommendations for EU action

Euro 6: Agree an ambitious RDE package that has strict not-to-exceed (NTE) limits for all pollutants, and which includes all engine operating conditions

NRMM: Align emission limits and testing for non-road mobile machinery with the provisions in place for Euro VI for HDVs

Testing: Introduce a system of random conformity of production checks and in-service testing overseen by an independent EU Type Approval Authority

Euro 7/VII: Commission proposal for Euro 7/VII limits for cars, vans and trucks to align limits for diesel, gasoline and natural gas vehicles to enable WHO air pollution guidelines to be met

Motorcycles: Agree Euro 5 standard for motorcycles and scooters and promote electric two-wheelers within a wider EU strategy on electro-mobility

EU law : Simplify EU infringement procedure to shorten the steps leading to penalties for non-compliant member states

Notes

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