

AECC RESPONSE TO STAKEHOLDER CONSULTATION ON EURO 5 EMISSION LIMITS FOR LIGHT-DUTY VEHICLES

AECC* is pleased to provide input to the Commission stakeholder consultation on the draft proposal for Euro 5 Emissions legislation for Light-duty Vehicles.

AECC believes that the European automotive industry is not only a key player in sustaining long-term growth and jobs throughout the European Union, but is also a crucial participant in the drive to improve air quality and minimise related health effects to the benefit of European society as a whole.

European legislators should present challenging EU emissions legislation for the future. This will then drive innovation and development in the motor industry. In turn it will result in economic growth and better air quality to the benefit of the whole community. Future emissions standards therefore need to include a clear long-term view of future requirements. These standards will determine whether or not active development of emerging technologies proceeds. Challenging emissions legislation will enable the industry's world-wide application of available and appropriate emissions control technologies.

CONTENT OF THE PROPOSAL

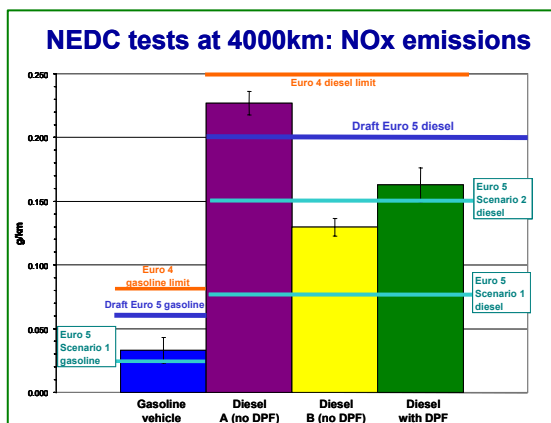
AECC would like to comment on the main issues raised in the Euro 5 proposal.

Our comments include reference to data drawn from the AECC Light-duty Test Programme conducted in the second half of 2004 at an accredited European type-approval laboratory and using four European-market Euro 4-certified production vehicles. The vehicles (one gasoline, one diesel with particulate filter and two diesels without particulate filter having different fuelling and emission control systems) were tested over the regulated (NEDC) test and other test cycles, with measurement of regulated emissions and of particulate mass and number to the PMP protocol being developed by the UN/ECE GRPE working group.

Note: Where "Scenario n" is shown on graphs or in text, this refers to the Scenarios used in the Commission's 2004 Stakeholder questionnaire on Euro 5 technology potential and cost.

DIESEL NOx

AECC's recent test programme on light-duty vehicles showed that a range of NOx levels within the current limits of 250 mg/km are possible with today's vehicles. The AECC test programme showed that a state-of-the-art Euro 4 diesel vehicle with good fuel economy already meets 150 mg/km, which was proposed in the Commission's 'Scenario 2'[‡].



The Euro 5 proposal of 200 mg/km calls for only a small (20%) reduction in diesel NOx emissions from the current Euro 4 limit on the basis that the technology for NOx after-treatment is not yet mature. Euro 5 vehicles will therefore continue to rely on mechanical engine measures such as exhaust gas recirculation (EGR) to control emissions over the test cycle.

The UK's Vehicle Certification Agency's database of Type Approval emissions results[§] shows that already almost one in two (45%) of diesel vehicles certified to Euro 4 levels meet this 200 mg/km limit.

[‡] average NEDC results for 3 different diesel vehicles were 227, 130, and 163 mg/km in the AECC test programme. Type approval results for the three vehicles were 196, 180 and 199 mg/km respectively.

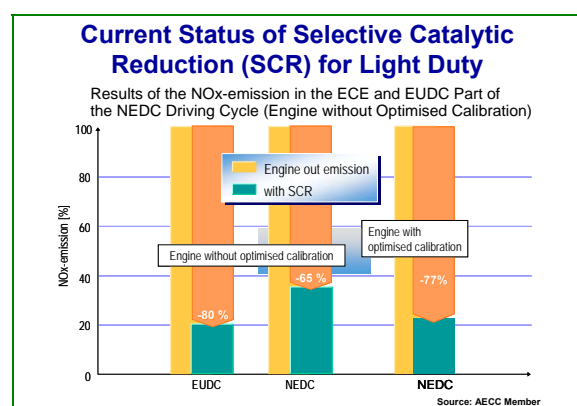
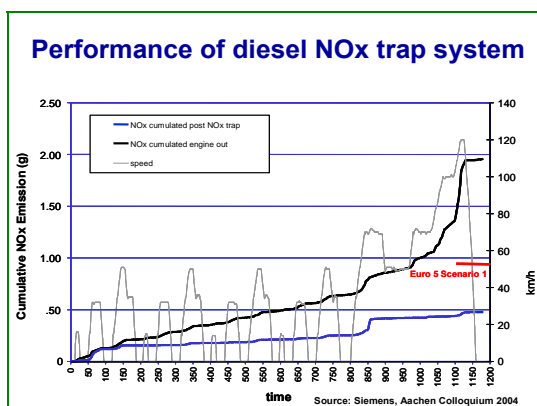
[§] <http://www.vcacarfueldata.org.uk/>: Status August 2005

AECC recognises that NOx aftertreatment for light-duty diesel vehicles is at the stage of applications development: the technology is fully-researched, practicable and available for productionisation. It should be recognised that these catalyst-based NOx reduction technologies are already in use in vehicles on the market in Europe:

- NOx adsorbers are used with direct injection gasoline and diesel engines,
- Lean NOx (HC-SCR) catalysts are coming in to use on a few light-duty diesel engines,
- Selective Catalytic Reduction (SCR) is the European motor industry's main technology choice to meet Euro 4 and Euro 5 emissions requirements for heavy-duty diesel engines and has been announced by some manufacturers for light-duty applications in the US.

In addition, the application development of NOx reduction aftertreatment to light-duty diesels is already under way to enable European manufacturers to meet US requirements for diesel emissions^{1,2} and hence to build upon the European motor industry's pre-eminent position in the light-duty diesel vehicle market.

The following results of tests on Light-duty NOx adsorber and SCR systems have recently been published.



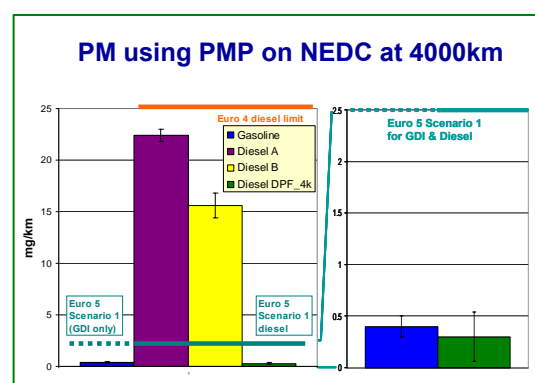
AECC recognises that the introduction of new technologies to reduce NOx emissions does pose cost issues for the motor industry. However, if there is no prospect of NOx control systems being required for future European vehicles, then there will be no impetus for their application in Europe and hence no forward movement on their development.

In view of the Member States' concerns over their ability to meet NOx air quality requirements in future, it would be appropriate to define a second stage for diesel NOx reduction to be applied at a later date. This approach has already been used for heavy-duty engine emissions, where definition of a two-stage approach for NOx has permitted development of the technologies to meet Euro 5 which are now already in use for Euro 4. This approach would then give the motor industry and their suppliers a long-term view of requirements and provide the impetus needed to ensure continued application development for NOx control.

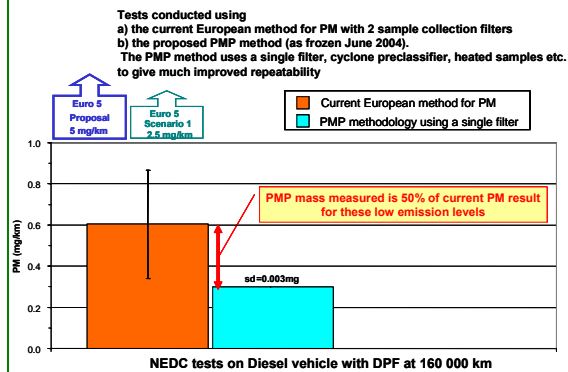
PARTICULATE MASS AND NUMBER

AECC Members are fully committed to the mass production of Diesel Particulate Filters (DPFs) that will be needed to meet the proposed requirements, and are rapidly expanding production in the EU25 to support the vehicle manufacturers' requirements. Type Approval data shows that vehicles across the size and power range already meet the proposed limit when fitted with a Diesel Particulate Filter.

The AECC test programme and the PMP programme have shown that current production vehicles incorporating a DPF emit less than 1 mg/km PM, readily meeting the Commission questionnaire 'scenario 1' figure of 2.5 mg/km.



PMP versus current EU gravimetric method

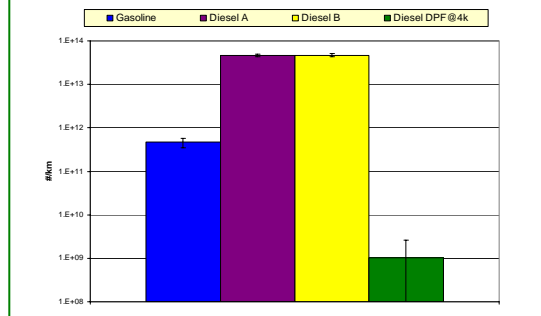


AECC is also active in supporting the development of improved, more repeatable mass measurement methodology in the UN/ECE GRPE Particulate Measurement Programme (PMP). AECC's contribution includes the provision of a standard production filter-equipped car as the 'golden vehicle' for the programme in addition to provision of results from AECC's own test work³ which used a different filter-equipped car and two diesel cars without filters. Reproducibility of the new procedure will be determined by the PMP programme.

AECC's results show that the new procedure provides improved repeatability but for filter-equipped cars records only about half the mass of the current Euro 4 procedure. This therefore aligns with the Commission statement that the PM mass emission limit will have to be recalibrated when a new PM measurement procedure is introduced.

AECC has also examined particle numbers and again has provided data on number measurement to the PMP programme. AECC's data showed that particle numbers were similar for two non-DPF diesel vehicles using different technologies, but those from a current DPF-equipped vehicle were several orders of magnitude lower and even lower than a gasoline vehicle. This applied not only to the NEDC but to all driving cycles tested.

Average particle numbers using CPC (NEDC)

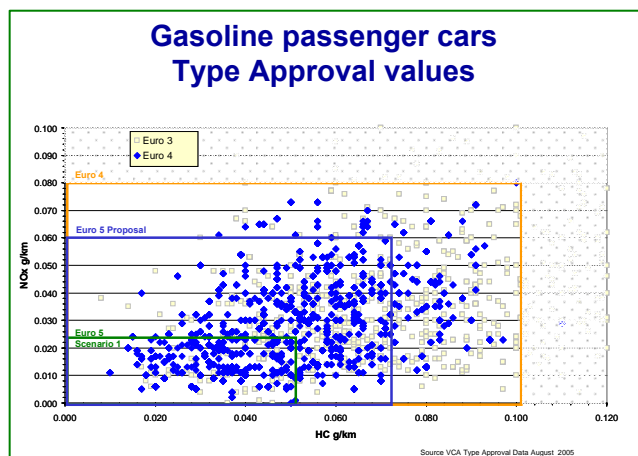


GASOLINE ENGINE NOx AND HC

The explanatory memorandum refers to the proposal for a 25% reduction in NO_x and HC limit values and notes that "many petrol vehicles currently sold in the EU are comfortably beneath this proposed emission limit, others can be made to respect it at relatively low cost."

Examining the UK's Vehicle Certification Agency database of Type Approval emissions results shows that of the Euro 4 gasoline vehicles listed**, 88% already meet both these limits. It is possible to achieve lower emissions at very limited on-cost. AECC provided a full and detailed response to the Commission Euro 5 questionnaire on Euro 5 technologies and their costs. The VCA data 'cloud' shows the wide range of emissions results for petrol vehicles. Detailed examination of the data shows that all types and sizes of vehicles can have very low emissions. The data show that 35% of today's Euro 4 petrol cars meet the most stringent of the Commission's questionnaire scenarios (Scenario 1).

Gasoline passenger cars Type Approval values



Reducing NO_x emissions from gasoline vehicles can contribute to the overall reduction in NO_x – especially given the limited reduction proposed for diesel NO_x - and hence assist with meeting the Member States' air quality requirements. The increasing market share of diesel vehicles across the European Union will inevitably lead to an increase in the total fleet NO_x emissions between

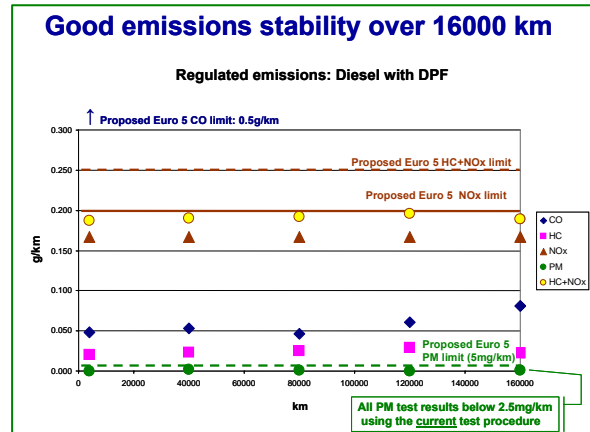
** <http://www.vcacarfueldata.org.uk/>: Status August 2005

now and 2010 despite the Euro 5 proposals. Lower emissions from gasoline vehicles can help offset this increase. The evidence from test work is that gasoline engine three-way catalysts ensure low NO_x emissions under all driving conditions, not just on the NEDC, which should be especially helpful in reducing real-world emissions. Technology is already available for European vehicles sold in the US to meet limits significantly lower than those proposed. The on-going development of improved catalysts formulations has ensured and will continue to ensure that improved emission levels can be achieved with no or minimal additional cost.

DURABILITY

The US Tier 2 requirements for durability already exceed the proposed figure of 160000km. Tier II requires 120000 miles (just under 200000km) durability to be demonstrated.

The recent AECC test programme demonstrated the durability of a current-production diesel vehicle with Diesel Particulate Filter (DPF) system to 160000km.



HEAVY PASSENGER VEHICLES

Similar technologies to those used for passenger cars are applicable to and available for Sports Utility Vehicles and other heavy (M1, >2500kg) passenger vehicles. As some of these vehicles may be special-purpose vehicles and will until now have had to meet less stringent standards than other passenger cars, it may be appropriate to allow such vehicles a slightly longer period for the transition to Euro 5 standards.

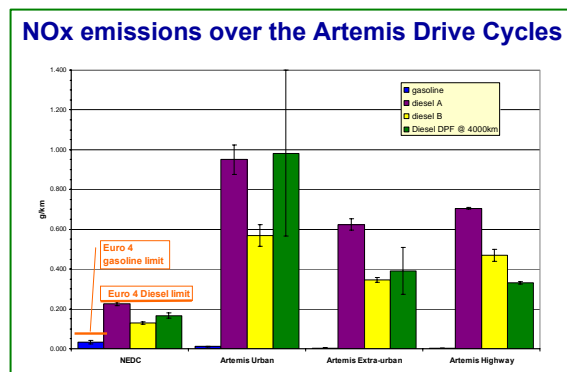
GENERAL

The preliminary draft proposal for a regulation refers to the requirement for the Commission to keep under review the need to revise the New European Drive Cycle (NEDC) to ensure the real world emissions correspond to those measured at Type Approval.

The AECC test programme incorporated emissions measurements for Euro 4 cars on the Artemis Drive Cycles. These demonstrated that emission levels on these cycles are not, in all cases, the same as those observed over the NEDC. As an example, vehicle NO_x emissions over the NEDC and the three Artemis drive cycles are shown in this graph.

Any future test cycle should reflect real-world operating and usage conditions.

In Table 1 the proposal refers only to emissions from petrol and diesel engines rather than from Spark Ignition and Compression Ignition engines. It needs to be made clear whether the same limits apply to other fuels such as LPG or natural gas.



It needs to be made clear whether the same limits apply to other fuels such as LPG or natural gas.

Article 2 (Scope) of the proposed text states that the regulation “applies to all motor vehicles with positive ignition engines... ” and Table 1 shows the proposed limits as applying to All Category M. On the other hand, its applicability to compression ignition engines is limited to categories M₁ and N₁ in both places. It therefore appears that the same requirements and limit values that are proposed for passenger cars would apply to, for instance, full-size buses powered by natural gas and even to category N vehicles such as refuse trucks if powered by natural gas, LPG or petrol.



NEW REGULATORY APPROACH

AECC welcomes the proposal to replace Directive 70/220/EEC and its numerous amendments with a new consolidated document, which will make the requirements clearer and more useable. The proposal for this to be a Regulation, rather than a Directive, will ensure consistent application across the Member States without inhibiting the option for them to put in place incentives for early application of future requirements if they deem it necessary.

The stakeholder consultation document covers only the co-decision (European Parliament and Council) part of the proposals. Technical details such as the test procedures and the composition and specifications of reference fuels are strongly linked to the measured vehicle emissions and to the relative severity of the limit values. To fully evaluate any proposals it is thus essential that both parts of the proposals are reviewed in parallel. It has been assumed throughout this response that the technical specifications implementing these provisions (the comitology proposal) will maintain the details shown in the current Directives, except where this has been indicated in the co-decision proposal. Nevertheless, it is essential that both parts of the 'split level' procedure are developed in tandem, to enable proper review and to ensure the correct interaction between them.

The 'split level' approach will assist in enabling the more rapid updating of the technical requirements as control and measurement technologies develop in future. It is important that this clear and vital link between limit values and the test procedure by which emissions are determined is maintained in future updates even though the two aspects may be separated in legislation.

The technical detail included in the current Directive is necessarily complex but has been found to be necessary to ensure good technical clarity for those operating and implementing the requirements (including the motor industry itself). The technical requirements are also critical to the effective operation and enforcement of legislation on vehicle emissions. AECC strongly believes that the detail of any new or revised text should therefore be subject to critical review through the existing mechanism of the Motor Vehicles Emissions Group (MVEG) during the process of development so as to fully ensure the involvement of experts from both the Member States and Stakeholders including Industries and NGOs.

The new proposal includes an effective date for Type Approval of 18 months after the date of entry into force. AECC is concerned that for future developments which (unlike the current move to fitment of Diesel Particulate Filters) have not been anticipated by the industry, this lead time may be too short, and suggests a Type Approval lead time of 2 years may be more appropriate whilst retaining the 'all registrations' proposal of 36 months from entry into force. Appropriate fixed Entry into Force dates could also be beneficial in this respect.

IN SUMMARY

AECC welcomes the proposals on Euro 5 and the opportunity to comment on them.

Diesel NOx: Today's state-of-the-art diesel vehicles are below the 150 mg/km NOx 'Scenario 2' value from the Commission's questionnaire. The motor industry, its supply base and European technology providers would be assisted by defining a second stage (Euro 6) for diesel NOx. Without this, application development of existing emission control technologies for Europe will not proceed.

Diesel PM: Today's state-of-the-art diesel vehicles are below the 2.5 mg/km PM 'Scenario 1' value from the Commission's questionnaire. The limit proposed is readily achievable by currently available technology and vehicles across the size and power range already meet it when fitted with a Diesel Particulate Filter. For vehicles with particulate filters, AECC concurs the statement in the proposal that improved particulate mass measurement methods yield lower mass results than the current procedure. The new procedure also provides significantly better repeatability. AECC's data also show that the particle number measurement procedure is robust and that particle numbers can be reduced by several orders of magnitude through the fitment of Diesel Particulate Filters.

Gasoline NOx and HC: Over 88% of current Euro 4 vehicles already meet the proposed limits. It is possible to achieve lower emissions at very limited on-cost. Technology is available for European vehicles sold in the US to meet limits significantly lower than those proposed for Euro 5.



Durability: The proposal of 160,000km is achievable and has been demonstrated for both gasoline and diesel vehicles.

Heavy Passenger Vehicles: Technologies similar to those used for passenger cars are equally applicable.

General: Technical details such as the test procedures and the specification of the reference fuels affect both the relative severity of the limit values and measured vehicle emissions. It is essential that both parts of the 'split level' procedure are developed and reviewed in tandem, to ensure the correct interaction between them. Clarification is needed on whether the limits proposed are intended to apply to Spark Ignition-engined vehicles other than Categories M₁ and N₁ and to other fuels such as LPG and CNG.

New Regulatory Approach: AECC welcomes the proposal to consolidate the existing Directive and its amendments into a Regulation using the split level approach. The mechanism of the Motor Vehicle Emissions Group (MVEG) remains essential to the effective development and operation of emissions requirements. AECC is concerned that for future developments which (unlike the current move to fitment of Diesel Particulate Filters) have not been anticipated by the industry, the 18 month lead time for Type Approval may be too short, and extending it to 2 years or defining fixed dates may be more appropriate.

You can contact AECC at info@aecc.be or +32 2 7068160.

Dirk Bosteels
Executive Director
AECC

07 September 2005

**AECC is an international non-profit scientific association of European companies engaged in the development, production and testing of catalyst and filter based technologies for vehicle and engine emissions control. This includes the research, development, testing and manufacture of autocatalysts, ceramic and metallic substrates and speciality materials incorporated into the catalytic converter and filter and catalyst based technologies to control diesel engine emissions (especially particulates and nitrogen oxides). Members' technology is incorporated in the exhaust emission control systems on all new cars and an increasing number of commercial vehicles, buses and motorcycles in Europe.*

AECC's members are: Argillon GmbH, Germany; Corning GmbH, Germany; Delphi Automotive Systems SA, Luxembourg; Emitec Gesellschaft für Emissionstechnologie mbH, Germany; Engelhard Technologies GmbH, Germany; Ibiden Deutschland GmbH, Germany; Johnson Matthey PLC, United Kingdom; NGK Europe GmbH, Germany; Rhodia Electronics & Catalysis, France and Umicore AG & Co. KG, Germany.

¹ Enderle, Breitbach, Paule & Keppeler (DaimlerChrysler AG); Selective Catalytic Reduction with Urea - The most effective Nitrogen Oxide Aftertreatment for Light-duty Diesel Engines; 26th Vienna International Motorsymposium, 28-29/04/2005

² Hammerle et al (Ford); Urea SCR and DPF System for Diesel Sport Utility Vehicle Meeting Tier II Bin 5; Diesel Engine Emission Reduction Conference (DEER), August 2003

³ AECC light-duty test programme – PMP measurement; UN GRPE/PMP meeting, Geneva, 31/05/2005; <http://www.unece.org/trans/doc/2005/wp29grpe/PMP-2005-15-01e.pdf>