



## AECC Response to the European Commission Stakeholder Consultation on the Revision of Directive 97/68/EC on Emissions from NRMM Engines

AECC\*, registered association n° 78711786419-61, welcomes the European Commission's initiative to revise the Non-Road Mobile Machinery Directive 97/68/EC. As a member of the GEME working group established to assist the European Commission in preparing a full amendment to Directive 97/68/EC, AECC generally supports the package of proposals made in 2010 including those for further tightening of emissions requirements of snowmobiles and Transport Refrigeration Units. AECC also supports the Euromot proposal of 12 May 2011 regarding extending the scope of EU constant speed engines so as to include also stationary engines. The planned revision offers an excellent opportunity to establish a sound and ambitious emissions legislative framework for future NRMM applications.

The on-going revision of the Thematic Strategy on Air Pollution by the European Commission's DG Environment has identified NRMM and small-scale combustion installations as key sources of emissions to be tackled. In order to generate the improvement in ambient air quality required by EU legislation:

- NO<sub>x</sub> emissions need further reduction to help resolve NO<sub>2</sub> limit breaches in most EU Member States,
- PM emissions need to be further reduced as there is no safe threshold for short-term exposure to ultrafine particles according to the World Health Organization (WHO) REVIHAAP project.

In 2012, the WHO International Agency for Research on Cancer (IARC) classified Diesel engine exhaust emissions as carcinogenic to humans. This assessment was based on epidemiological studies in which the engines were not equipped with particulate and NO<sub>x</sub> aftertreatment systems. Studies show that a minimized number of ultrafine particles will benefit society in general and machinery operators in particular.

In addition, a reduction in Black Carbon emissions will produce a co-benefit for climate change as Black Carbon has a high global warming potential.

It is therefore desirable that Stage IV requirements are extended to applications for which no Stage IV is currently defined (e.g. locomotives, inland waterway vessels) or where no emissions requirement is defined at all (e.g. SI engines above 19 kW that are promoted for gaseous alternative fuel applications) and that the future standard **Stage V** is developed along the following lines:

- **Emissions control technologies are readily available** to enable future NRMM requirements to align with on-road Euro VI emissions legislation. They are in use on Heavy-duty vehicles in the USA (since 2010), in Japan (since 2009) and in Europe.
- Emissions legislation compliance should be achieved in **real-world operation**.
- **A lower PM mass** aligning with Heavy-duty Euro VI requirement should be defined.
- **A single PM number limit** should be defined for all NRMM engines above 19 kW. The **Heavy-duty PMP (Particulate Measurement Program) protocols** developed by UNECE can readily be used to measure PM mass and PM number emissions of non-road engines.
- The **future Stage V legislation should cover all NRMM CI and SI engines** including the smaller (<37 kW) and the larger ones (>560 kW) with the outlook of simplifying legislation by reducing the number of engine power bands and harmonizing their emissions requirements.
- Current legislation on agricultural tractors refers to the NRMM legislation with regard to emissions requirement. This linkage should be maintained with any new regulation.
- Alternative fuel applications should promote climate-friendly technologies. In the case of LNG methane emissions with a much higher global warming potential than CO<sub>2</sub> should not be neglected. To ensure efficient solutions are deployed, a **specific CH<sub>4</sub> limit** could be defined for example.
- There should be **fuel-neutrality** (gaseous/liquid fuels) in terms of emissions limits.



- There should be **identical emissions limits and introduction timing** for constant speed and variable speed engines.
- The future Stage V should apply to all NRMM engines and machinery categories **without exemption**. Exemptions and derogations delay the benefit to the environment and prevent economies of scale. The increased flexibility allowance introduced for Stage IIIB engines have for example delayed the benefit of the tighter Stage IV emissions standard.
- Given the availability of technologies, **introduction 3 years after publication in OJ** should ensure sufficient lead time to the industry. In that context, the use of a Regulation rather than a Directive would allow faster introduction, avoiding time delays due to transposition into Member States national laws.

This position is primarily based on the emissions control industry's global experience with state-of-the-art emission control technologies such as those Euro VI systems now available in production from most major Heavy-duty vehicle manufacturers and is specifically backed with test results obtained by AECC in 2010 throughout an extensive technical project<sup>(1)</sup> using a diesel, 4-cylinder, 4.4-litre, 93 kW base engine widely available globally. This program used a prototype version of the engine specifically developed for NRMM Stage IIIB applications, with cooled EGR, which gave an engine out NOx level of around 3 g/kWh over the Non-Road Transient Cycle (NRTC).

The technical feasibility of Stage IV emissions limits (with a large engineering margin) was confirmed through the combined application of an integrated emissions control system comprising a Diesel Oxidation Catalyst (DOC), Diesel Particulate Filter (DPF) and Selective Catalytic Reduction (SCR) system with associated urea injection system and ammonia slip catalyst. Compared with the existing non-road engine population, the tailpipe results achieved in this demonstration project point the way to future low emissions solutions and a feasible future emissions stage.

In addition to determining regulated gaseous emissions, and real-time gaseous nitrogenous speciation, the test program included many particle analysis approaches: particle numbers to the Heavy-duty PMP protocols, particle size distributions and particulate mass by two methods. PM emissions results and particle number measurement results over NRTC and NRSC tests showed the effectiveness of the emissions control system both for the removal of particulate mass and the reduction in the number of ultrafine particles, over a variety of operating conditions. The PMP method as developed by UNECE GRPE for on-road Heavy-duty engines can be readily used to measure particle emissions (PM and PN) of NRMM engines. The HD-PMP method proved to be very robust for measuring PM and PN emissions and future on-road Heavy-duty Euro VI-like PM and PN emissions levels were demonstrated as technically feasible. Engine-out PN data of 0.6 to  $3 \times 10^{14}$ /kWh were similar to other diesel engines tested in previous PMP and AECC Heavy-duty programs. All transient cycles' data showed tailpipe PN emissions well below  $10^{11}$ /kWh, steady state cycles showed PN emissions below  $2 \times 10^{11}$ /kWh, correlating to a >99% efficiency for particulate number reduction by DPF in both cycles.

Should you need more information, you can contact AECC at [info@aecc.eu](mailto:info@aecc.eu) or at +32 2 706 8160.

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*\*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 engine emissions. Members' technology is incorporated in the exhaust emission control systems on all new cars and an increasing number of commercial vehicles, buses, non-road mobile machinery and motorcycles in Europe.*

More information on AECC can be found at [www.aecc.eu](http://www.aecc.eu). Information on emissions control retrofit for existing heavy-duty vehicles and non-road machinery can also be found at [www.dieselretrofit.eu](http://www.dieselretrofit.eu).

AECC's members are: BASF Catalysts Germany GmbH, Germany; Corning GmbH, Germany; Emitec Gesellschaft für Emissionstechnologie mbH, Germany; Ibiden Europe B.V. Stuttgart Branch, Germany; Johnson Matthey PLC, United Kingdom; NGK Europe GmbH, Germany; Solvay, France; and Umicore AG & Co. KG, Germany.

**Reference:**

<sup>(1)</sup> AECC Measured Emissions from a Dedicated NRMM Engine fitted with Particulate and NOx Emissions Controls, [www.aecc.eu/content/pdf/100921%20AECC%20NRMM%20Test%20Program%20SAE%20HDD%20Gothenburg.pdf](http://www.aecc.eu/content/pdf/100921%20AECC%20NRMM%20Test%20Program%20SAE%20HDD%20Gothenburg.pdf).