



## Summary on AECC Technical Seminar on Emissions from Non-Road Mobile Machinery

Brussels, 27 November 2012

On 27 November 2012, AECC\* held a Technical Seminar on emissions from Non-Road Mobile Machinery. More than 80 people attended the seminar, including 8 from the European Commission and 18 from EU Member States.

After an introduction by AECC's Executive Director, Dirk Bosteels, Mr. Thomas Verheye Head of the European Commission's Industrial Emissions, Air Quality, and Noise Unit in DG-Environment, spoke on 'NRMM Emissions in the Context of the Upcoming Review of the EU Air Quality Policy Framework'. The final draft baseline data for review of the Thematic Strategy on Air Pollution will be available in March 2013. Actions under consideration for emissions abatement include the revision of the NEC (National Emissions Ceilings) Directive, Euro 6 (incl. real-world emissions) and SULEV incentives, small scale combustion installations (<50 MW) and Non-Road Mobile Machinery emissions.

Mr. Verheye was followed by Mr. Philippe Jean, Head of the Sustainable Mobility and Automotive Industry Unit of the European Commission's DG-Enterprise & Industry who spoke on the subject of the Future Stages IV & V Legislation for NRMM. He said that, given the problems of air quality in Member States (especially at hotspots) for PM, NO<sub>x</sub> and ozone, there is a need to proceed with measures to further reduce emissions at source. He too noted that the NRMM contribution is increasingly important. He commented that the IARC statement on the carcinogenicity of diesel exhaust is of importance, and the European Council and Parliament have already asked the Commission to address the issue of diesel particles in the revision of the NRMM Directive. For Mr Jean, potential elements of the Commission's response include extending the scope of the NRMM Directive 97/68/EC to additional power classes and applications such as smaller and bigger CI engines, stationary engines, SI engines >19 kW, and snowmobile engines, adding In-Service Conformity provisions, introducing stage IV for CI engines between 19-37 kW and inland waterway vessels, and considering Euro VI limit values as a point of orientation for a future Stage V. Commissioner Tajani's cabinet had stressed the importance of the dossier, Mr. Jean said. There will be a public consultation starting in December, with a stakeholder hearing in January 2013. Preparation of the Impact Assessment, looking at technical progress and economic impacts, will proceed in parallel. The proposal will not be ready in time to be considered by the current Parliament, Mr. Jean concluded.

Dr. Magnus Lindgren of the Swedish Transport Administration, who chaired the Commission's GEME Working Groups on the development of the NRMM Directive, then spoke on 'Measures to improve Air Quality'. He discussed the use of low aromatics, low sulfur fuel (Swedish Environmental Class 1) in existing vehicles/machines as one option, saying that this can result of reductions of 10-30% in PM (depending on the engine technology) and 10-15% NO<sub>x</sub> regardless of engine technology, as well as a reduction in PAH emissions. The use of DPFs, though, reduces both particulate and PAH emissions. NRMM consumes around one tenth of the fuel but produces about 40% of the particle emissions. The next step should be a particle number limit for NRMM. Stage V is needed before 2020.

The second session started with a presentation on 'Black Carbon (BC) and Global Warming' from Mr. Jos Dings of Transport & Environment. He pointed out that it is now a recognised that BC has a significant short-term radiative forcing effect and said that about 25% of BC is from diesels. The EU is the largest contributor to BC deposition in the Arctic, which increases melting of snow and ice. The use of DPFs will reduce BC emissions from diesel vehicles, but not, under current legislation for NRMM. T&E wants to see the Euro VI particle standard (including particle number) as the basis for NRMM particulate limits. The loopholes in the current Directive (stationary engines, small and large engines etc.) need to be closed.

This presentation was followed by Prof. Dr Peter Hoet of KU Leuven who discussed diesel exhaust-related health effects. He discussed both short-term and long-term effects of particles on health outcomes such as cardiovascular problems, chronic obstructive pulmonary disease (COPD), atherosclerosis, carcinogenicity and asthma. He considered the effects of PM<sub>10</sub>, PM<sub>2.5</sub> and ultrafines in relation to these issues, the concerns on their effects on susceptible populations (especially children) and recent evidence that the hazards are increased with freshly emitted particles.

The second session of the seminar concluded with a talk on 'Mobile Machinery and Urban Air Quality - Impacts and Measures' from Mr. Hinrich Helms of the Institut für Energie und Umweltforschung (IFEU). He noted that although particle emissions from NRMM will decrease in the future, this will be to a lesser extent than from road transport, and emissions from small equipment (18-36 kW) will not decrease and may even increase.

'The Swiss Experience with NRMM' started the afternoon sessions, presented by Dr. Martin Schiess from the Swiss Federal Office for the Environment (BAFU/FOEN). He opened his presentation by saying that if water is polluted, you can drink bottled water. You cannot do the same for air! He described the Swiss Ordinance on construction equipment and its requirements, which includes particle number limits.

Dr. Alois Krasenbrink of the European Commission's Joint research Centre (DG-JRC) then described the development of the PMP Protocol for Particle Number and improved Particulate Mass measurement. He commented that NRMM of over 56 kW account for some 84% of PM emissions across Europe.

Dr. Raimund Müller of Emitec, the chairman of the AECC NRMM & REC sub-group, then presented the results of the AECC NRMM Test Programme which was conducted at Ricardo in 2009-2010 and demonstrated the potential to meet Euro VI-like limits and showed the applicability of PMP for NRMM emissions measurement. At the end of the presentation, Ricardo's Chris Such commented that the common rail fuel injection system used in that programme was 1600 bar pressure. They had since tested up to 3000 bar – this can reduce PM and PN, but they still cannot meet the potential Stage V limits without a DPF.

In the final session, Dr. Richard O'Sullivan of Johnson Matthey presented the challenges and opportunities for NRMM Retrofit in Europe, noting that the market is currently for 2 to 3000 units per year, compared to about 500 000 original equipment engines.

This was followed by a presentation on future small SI engines by Dr. Holger Lochmann of Stihl on behalf of Euromot. He showed the variety of technologies that have been developed to meet Stage II emissions limits and said that there were 1040 small hand-held equipment engine families last year. The current emissions stages are internationally harmonised because of the needs of economy of scale, but the timescale is not – hence the long series of exceptions and derogations in the EU Directive. The main source of PM emissions is scavenging losses – thermogravimetric analysis indicates that the solid fraction amounts to only 2-3%. PM can, though, be reduced by reducing the ratio of oil to fuel for 2-stroke engines.

The final presentation was from Mr. Gerhard Rickert of BASF Catalysts, a member of the AECC Technical Steering Committee and NRMM & REC sub-group, who presented the results of AECC's recently-completed test programme on small hand-held equipment. Tests were conducted on two 4-Stroke machines (one with a dry sump lubricated engine, one with a fuel/oil mixture lubricated engine) and four 2-Stroke machines – a simple, low cost solution with catalyst; a high performance engines with catalyst; a high performance engine with an innovative scavenging process without catalyst; and a high performance engine with an electronically controlled injection system without catalyst. Measurements included regulated emissions, particulate mass and particle number. There were also some measurements of particle size distribution, of the effect of evaporation tube temperature on particle numbers, and of the effect of oil type.

Dirk Bosteels then wrapped up the day's presentations before inviting participants to a small reception hosted by AECC.

All presentations can be downloaded from [www.aecc.eu/en/Publications/NRMM\\_Technical\\_Seminar.html](http://www.aecc.eu/en/Publications/NRMM_Technical_Seminar.html).

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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 internal combustion 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, non-road mobile machinery and motorcycles in Europe. More information on AECC is at [www.aecc.eu](http://www.aecc.eu) and [www.dieselretrofit.eu](http://www.dieselretrofit.eu).*

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