Emissions Control Technologies for Mobile Pollution Sources

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Major Pollutant Sources and Source Identification
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Association for Emissions Control by Catalyst (AECC) AISBL

AECC members: European emissions control companies

Technology for exhaust emissions control on cars, buses and commercial vehicles and an increasing number of non-road applications and motorcycles.
Core Emissions Control Technologies

The chemistry, physics, engineering and production technology for catalysis, media for filtration and catalyst support and speciality materials used in automotive catalysis, filtration and filter regeneration.

- Three Way Catalyst
- Oxidation Catalyst
- NOx Adsorber
- Selective Catalytic Reduction
- Particle Filtration

\[
\begin{align*}
\text{NO}_x + \frac{1}{2} \text{O}_2 & \rightarrow \text{NO}_3^- \\
\text{NO}_x + \text{O}_2 & \rightarrow \text{NO}_x \\
4 \text{NO} + 4 \text{NH}_3 + \text{O}_2 & \rightarrow 4 \text{N}_2 + 6 \text{H}_2\text{O} \\
6 \text{NO}_2 + 8 \text{NH}_3 & \rightarrow 7 \text{N}_2 + 12 \text{H}_2\text{O}
\end{align*}
\]
## Applicability of Emissions Control Technologies

<table>
<thead>
<tr>
<th>Technology</th>
<th>Light-duty</th>
<th>Heavy-duty</th>
<th>NRMM</th>
<th>Motorcyle &amp; Moped</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acronym</td>
<td>Petrol</td>
<td>Diesel</td>
<td>Gas, Petrol</td>
</tr>
<tr>
<td>Oxidation catalyst</td>
<td>OC</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diesel Oxidation Catalyst</td>
<td>DOC</td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>3-Way Catalyst</td>
<td>TWC</td>
<td>●</td>
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<td>●</td>
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<tr>
<td>Diesel Particulate Filter</td>
<td>DPF</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>NOx Adsorber</td>
<td>LNT</td>
<td>●</td>
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<tr>
<td>Selective Catalytic Reduction</td>
<td>SCR</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Gasoline Particulate Filter</td>
<td>GPF</td>
<td>●</td>
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</tbody>
</table>
Mobile Pollutant Sources

- Road transport remains a key source of pollutant emissions.

- Lower emissions from cars, trucks and buses means that non-road machines, motorcycles and marine sources are more significant.

Source: EEA, 2013

NOx
- Transport 58%
- Non-transport sectors 42%

Primary PM$_{2.5}$
- Transport 27%
- Non-transport sectors 73%

- Road transport exhaust
- Road transport non-exhaust
- Railways
- Domestic shipping
- International Shipping
- Domestic Aviation
- International aviation

Source: EEA, 2013
Emissions Control Technologies have enabled major reductions in the emissions of key pollutants over the last 20 years. Particulate and NOx emissions remain a key concern. Internal combustion engines will remain an important part of new vehicle production for many years to come, so progress needs to continue and to ensure full performance under real driving conditions.

Source: International Energy Agency technology roadmap 2012
Automotive Pollutant Sources

- Automotive sources remain an important source of pollutant emissions – especially for NOx and fine particles.
- The red areas on these contour graphs of emissions vs. speed and acceleration show the regions of highest NOx emissions.
- They show what can be achieved with Euro 6 technologies.

Gasoline Particles Control

• The number of particles emitted by DI gasoline vehicles is higher than the PN levels allowed for diesel cars.

• The EU has introduced a PM number limit from 2014.

• Gasoline Particulate Filters offer an option to reduce these emissions not only on the test cycle, but under a wide range of driving conditions.

Source: AECC light-duty test programmes

Source: AECC member company
Heavy-duty Vehicles Emissions

- Euro VI vehicles are expected to use SCR and DPF.
- Euro VI will reduce NOx & PM emissions by 95% and 97% respectively, compared to 1992 standards.

Source: AECC Euro VI Heavy-duty test programme
Non-Road Mobile Machinery Emissions

- For NRMM, there is no Stage IV for many types of engine.
- Even Stage IV will not force control of ultrafine particles on all machines.
- There is the potential to align performance with that of on-road engines.
- AECC demonstrated these technologies in 2010, including major reductions in the number of ultrafine particles under all operating cycles.

Source: AECC NRMM test programme

Particle Number emissions; NRMM engine fitted with DPF

Source: AECC NRMM test programme
Motorcycles and Mopeds Emissions

- The two key issues are to ensure real durability and (for some mopeds and motorcycles) to ensure the proper calibration of the system so as to enable reliable emissions control technologies.

Source: AECC motorcycles programme
Innovating for Cleaner Air

• There are significant areas for further improvement in air quality in Europe.

• The emissions control industry continues to develop innovative solutions.

• Further reductions in mobile source emissions are possible through:
  – Reduction of particle emissions from gasoline engines,
  – Reduction of particle emissions from Non-Road Mobile Machinery,
  – Effective control of motorcycle emissions.

• Effective regulation and control of emissions over the whole engine map are needed to ensure that real-world benefits are delivered to the consumer and the society.
Thank you for your attention

More information available from
www.aecc.eu