The Swiss experience with reducing diesel soot from construction machinery

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DPF retrofit requirements for tunnel construction sites (2000)

Tunnel workers at the Gotthard construction site of the new transalpine rail link.
Federal Guideline: DPF retrofit requirements for large construction sites (2002)

- Increasing number of retrofit projects and policies on a local level on major construction sites (Zurich airport, motorways)
Federal regulation for machinery used on construction sites (2009)

1. Construction machines must meet the requirements of Directive 97/68/EC.
2. Additionally, emissions may not exceed the particle number of $1 \times 10^{12}$ particles / kWh.
3. This requirement is deemed to be met if the machine is operated with a certified DPF fulfilling specified criteria (i.a. 97% abatement efficiency for particles 20-300 nm).
Testing of Conformity

2 options for testing of conformity:

- testing of PN limit value on original equipment (OEM engine) in NRSC and NRTC test cycles according to UNECE PMP test protocol

or

- testing of retrofit DPF system according to Swiss test protocol
PN limit value: Type approval testing

- Accredited (ISO/IEC 17025) testing laboratories recognized by FOEN:
  - Bern University of Applied Science (AFHB, CH),
  - AVL-MTC Motortestcenter AB (AVL-MTC, S)
  - Southwest Research Institute (SwRI, USA)
  - Japan Automobile Research Institute (JARI, JP)
  - TÜV NORD Mobilität GmbH & Co. KG (D)

- 36 engine families covering 306 engine types:
Test results

Swiss PN-Limit (1x10^{12} / kWh)

EURO VI HDV PN-Limit (6x10^{11} / kWh)

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Conclusions

• DPF are a proven technology for carcinogenic diesel soot removal from construction machinery emissions.
• Particle number emission limit value assures equipment with high efficiency DPF.
• Several currently available EU stage IIIB engine types can meet a particle number limit value similar to EURO VI for HDV without modification.
• To avoid adverse effects on human health, further regulation for all diesel powered non-road mobile machinery and vehicles should include a particle number limit value.