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MDEC 2009: Forum on Diesel Particulate Filters (DPFs)

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CDC NIOSH

Diesel Particulate Filters (DPFs) in North American Underground Mines

- Currently DPF systems are available to underground mining industry primarily as aftermarket applications for heavy- and light-duty diesel engines.
- Retrofit DPF systems present in relatively large number in U.S. coal mines and in fair number in U.S. and Canadian metal mines. At this time, DPF systems are not perceived as a viable technology for curtailment of DPM emissions from diesel powered equipment in nonmetal mines. The only DPF systems in the OEM applications currently present in underground mines are those in on-highway light-duty pickup trucks used by underground mining industry for transport of people and goods.
- DPF are recognized as a very efficient in removing DPM mass emissions but major issues remain to be:
  - durability and reliability;
  - regeneration;
  - NO_2 slip;
  - safety…

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Trends and Advancements in DPFs Technology

- In general, passive systems are favored over active systems.
- The systems with NO_2 slip control catalyst emerged.
- Hybrid systems with backup electrical regeneration are extensively evaluated.
- DPFs are still perceived as the last line of defense. The strategies based on ventilation, gradual replacement of the engines with clean ones, improved maintenance, and alternative fuels appear to be favored over those based on implementation of DPF systems.

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Diesel particulate filter (DPF) and selective catalyst reduction (SCR) systems should soon become available to UG mining industry as integral part of HD engines (OEM applications).

- Promising technologies but number of potential issues remain to be assessed:
  - cost;
  - size of the power packages;
  - NO_2 slip;
  - complexity;
  - reliability;
  - urea handling and consumption (SCR systems).

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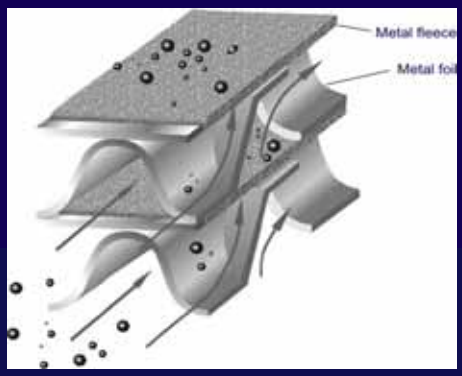
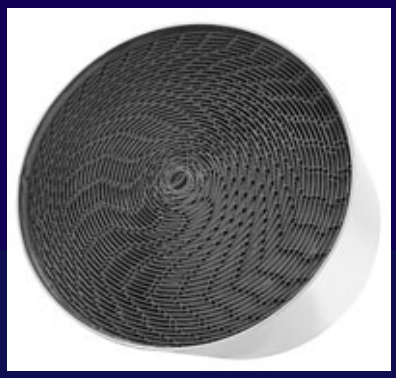
Flow-through-filters (FTF) catch attention of a number of the operators.





- Theoretically, over 50% removal (CARB Level 2);
- No regeneration and high engine backpressure issues;
- Absence of regeneration and DPM buildup affects FTF performance;
- Storage and release (blow-off) phenomenon;
- Secondary NO_2 emissions.

Other than Tailpipe Emissions: Crankcase Emissions

- Crankcase blowby can be an important source of particulate emissions:
  - up to 20% of tailpipe PM emissions from Tier 2 and Tier 3 engines;
  - can exceed tailpipe PM emissions from Tier 4 engines.
- Crankcase emissions are primarily composed of soluble organic compounds.
- In some Tier 2 engines organic carbon emission rates are found to higher from the crankcase than from the tailpipe.

Controls for Crankcase Emissions

- In the open crankcase ventilation systems gases and PM are vented to the atmosphere:
  - filtered;
  - not filtered.
- In the closed crankcase ventilation (CCV) systems crankcase gases and PM are typically filtered and routed back to:
  - the intake system;
  - the exhaust system (upstream of DOC and DPF).
- Filtration/separation technologies for CCV systems:
  - Inertial separators (typically centrifugal);
  - Coalescing filters.

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Thank you for your attention!

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