WEST COAST COLLABORATIVE
A public-private partnership to reduce diesel emissions

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Diesel Retrofit Technology and Verification Overview

Presented by Joseph Shacat

For the West Coast Collaborative
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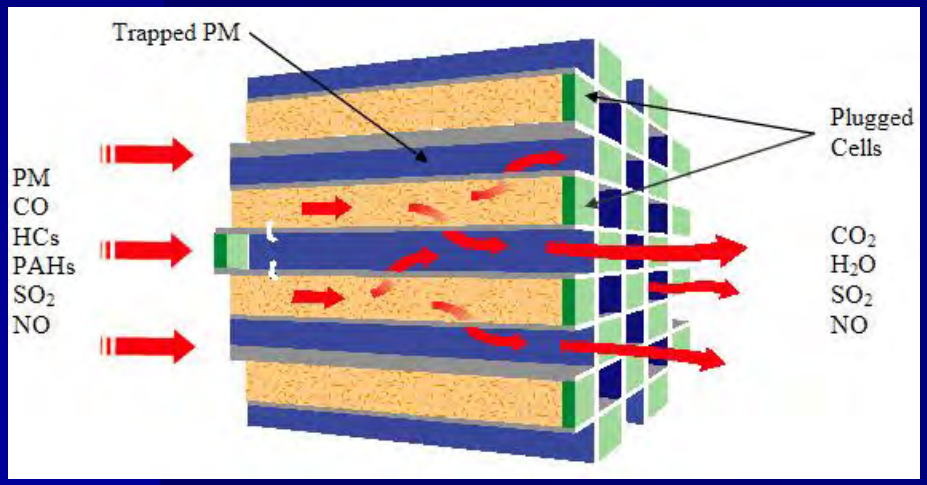
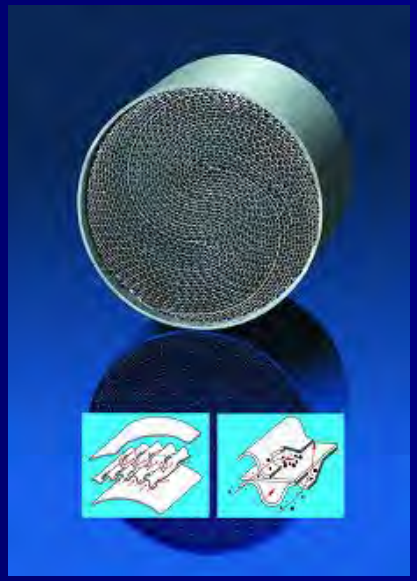
DPF – Diesel Particulate Filter

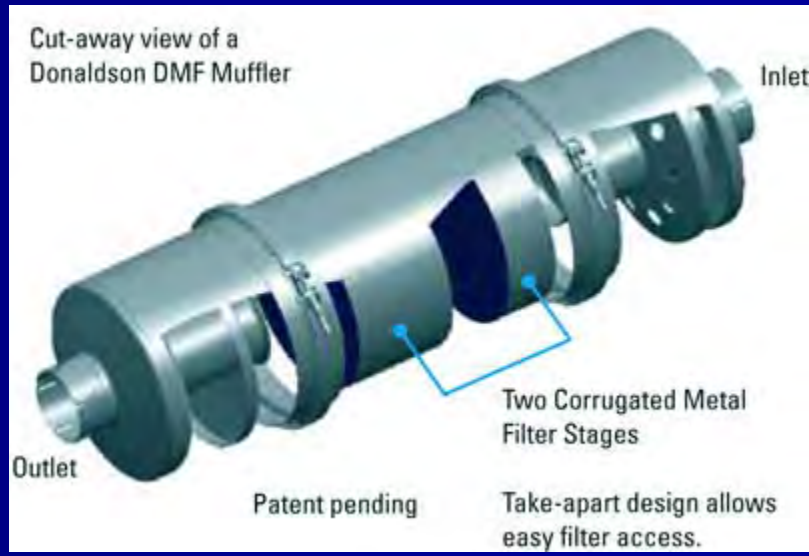
- "Wall-flow" Filter with a ceramic substrate
  - Corderite or Silicon Carbide
- Passive Systems – Require high exhaust temperature
- Active Systems – No exhaust temperature requirement
- Routine Maintenance Required
- Must use ULSD fuel



DMF – Diesel Multistage Filter
DPR – Diesel Particulate Reactor
FTF – Flow Through Filter

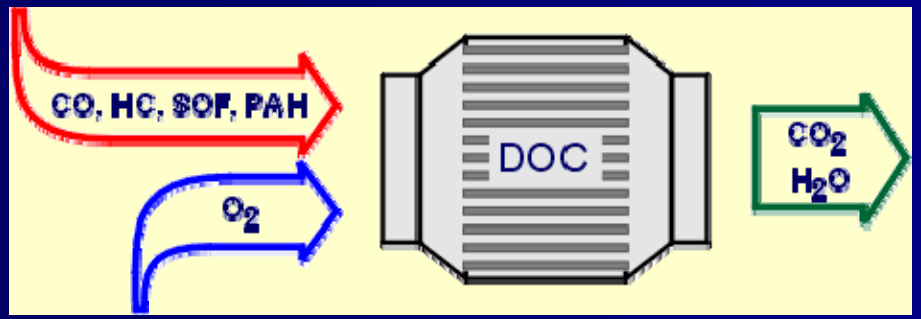
- Stainless steel substrate
- No maintenance required, but can be taken apart in the event of engine failure
- Must use ULSD fuel
- Less stringent exhaust temp requirements than DPF





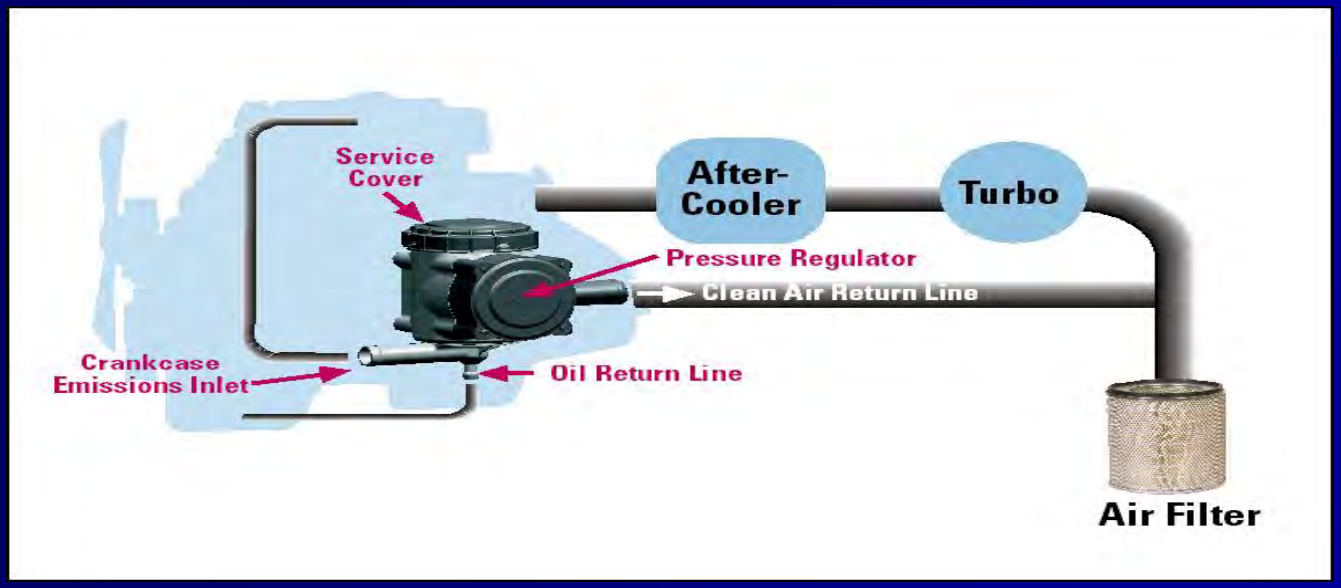
DOC – Diesel Oxidation Catalyst

- Most widely used and available technology
- No maintenance required
- Can be integrated with the muffler
- Can be used with almost any fuel



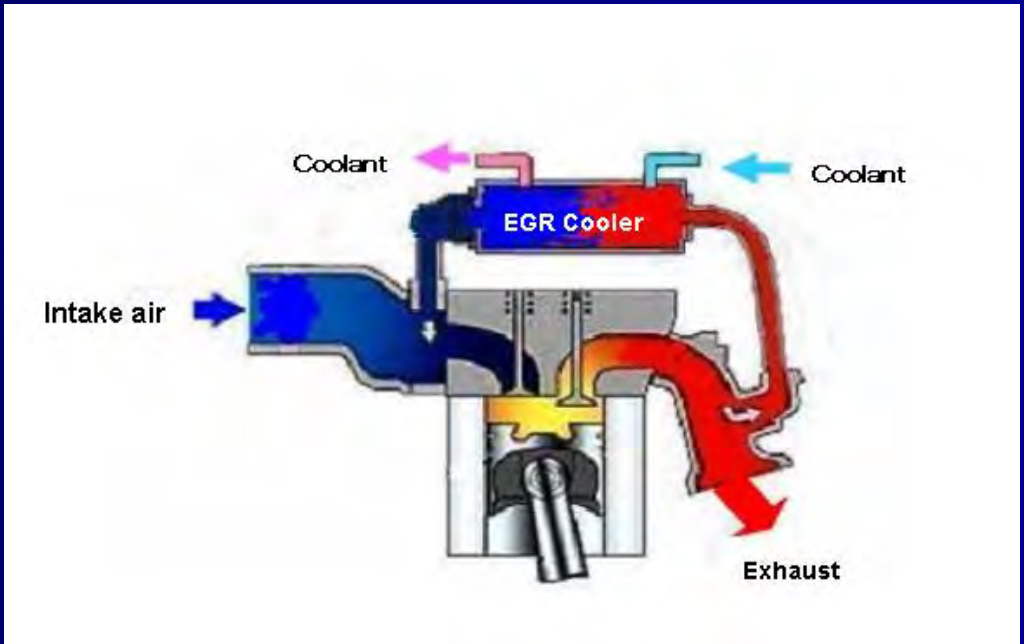
CCV – Closed Crankcase Ventilation System

- Eliminates crankcase emissions (“blow-by”)
- Oil is returned to the oil pan
- PM is trapped in an air filter, which must be replaced periodically



EGR – Exhaust Gas Recirculation

- Exhaust gas is recirculated back into the pistons
- Less oxygen causes a reduction in NOx emissions
- PM emissions increase when EGR is employed



SCR – Selective Catalytic Reduction

- Designed to reduce NOx emissions
- Reducing agent (e.g., urea) is injected into the exhaust flow
- Can be coupled with a DPF to also target PM emissions

LNC - Lean NOx Catalysts

- Similar to SCR, but more modest NOx reductions
- Diesel fuel is injected into the exhaust flow (instead of urea)
- Slight impact on fuel economy due to injection of diesel fuel
- Can be coupled with a DPF to also target PM emissions

Diesel Retrofit Verification

- Retrofit manufacturers thoroughly evaluate retrofit devices
  - Quantifiable emissions reduction
  - Durability of the products
- Data is submitted to the EPA and/or CARB for verification
- Devices are verified for specific engine families and years
- Additional criteria are included
  - Fuel type (e.g., Biodiesel, ULSD)
  - Fuel additives
  - Existing emissions control devices (e.g., EGR)
  - Engine characteristics

Diesel Retrofit Verification

- Level 1 – 25% PM reduction
- Level 2 – 50% PM reduction
- Level 3 – 85% PM reduction