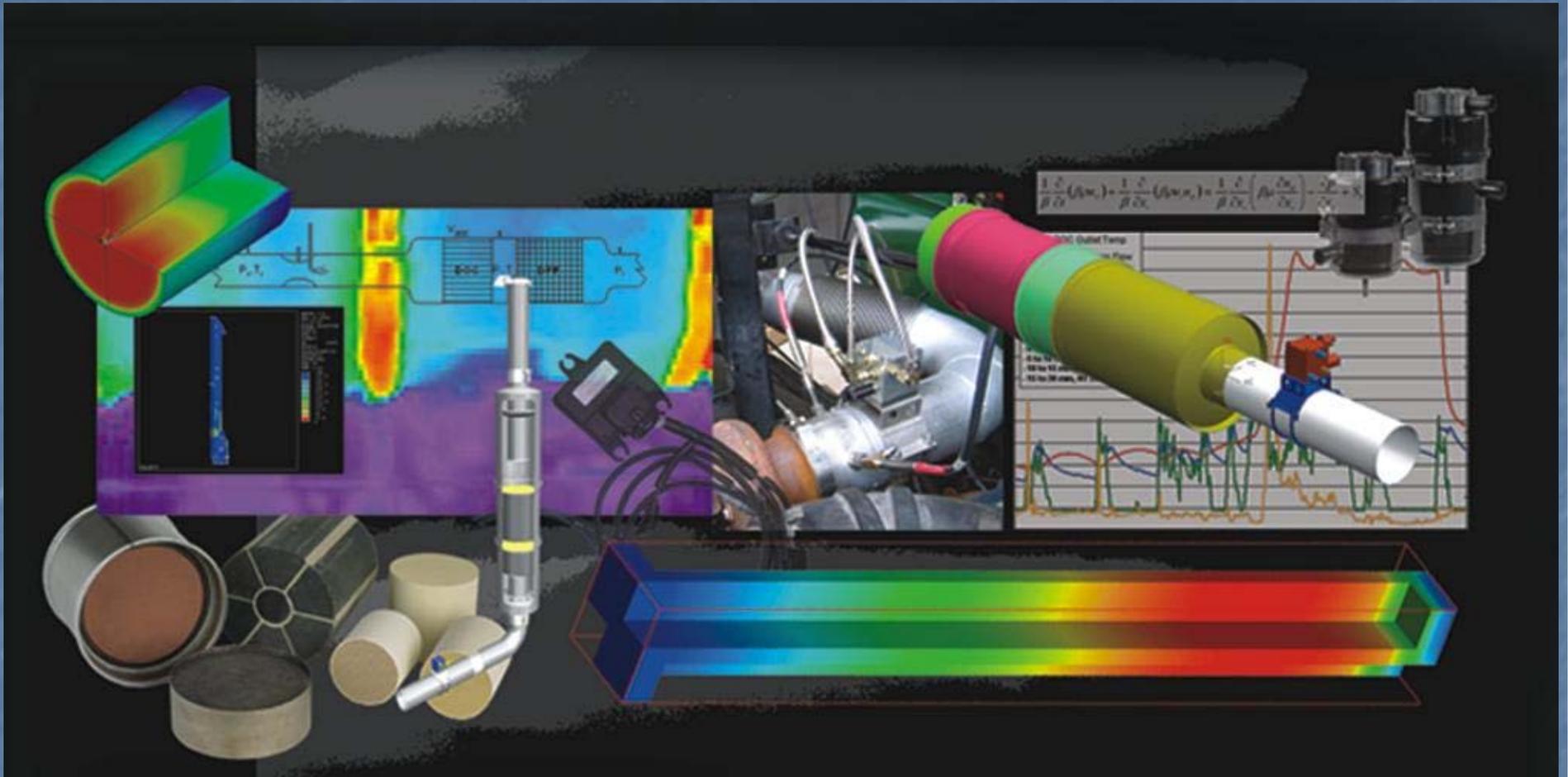


Exhaust Retrofit Emission Technology



Health Effects of Diesel Emissions

- Short- and long-term respiratory problems
- Cardiovascular problems
- Trigger asthma attacks
- Irritate eyes, nose and throat
- More dramatic impact on children

Retrofit Opportunities

- School Buses
- Urban Buses
- Refuse Vehicles
- Municipal Vehicles
- Off-road Equipment



Retrofit Products

3 Primary Levels

C.A.R.B Level 1,2,3

California Air Resource Board

"Total Engine Emissions" Approach

- Focuses on tailpipe and crankcase emissions...
 - Tailpipe
 - DOC Muffler - Good
 - DMF Muffler - Better
 - DPF Muffler - Best
 - Crankcase Emissions
 - Spiracle CFS - Best
- Apply technology that meets goal!

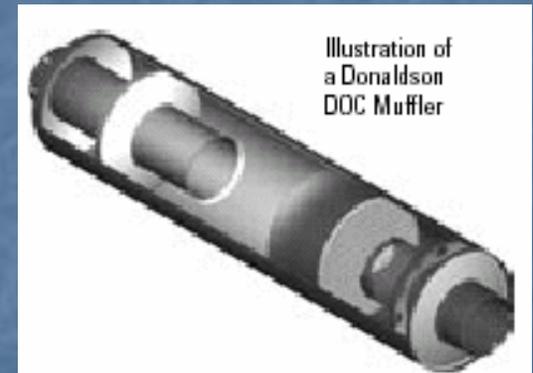
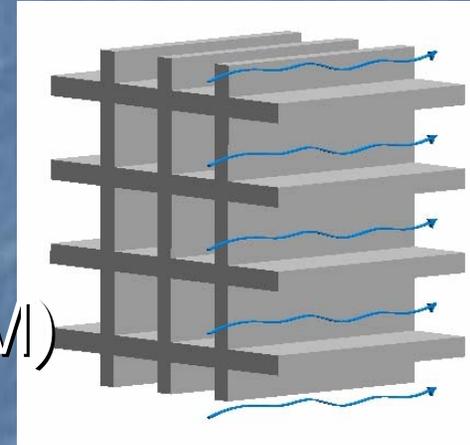


Retrofit Products

- Diesel Oxidation Catalyst (DOC)
 - 20 - 40% PM reduction-Level 1
- Diesel Multi-Stage filter (DMF)
 - 60% PM reduction-Level 2
- Diesel Particulate Filter (DPF)
 - 85 +PM reduction –Level 3
- Spiracle™ Crankcase Filtration System
10-28% PM reduction
- DPF Cleaning System - Pulse Cleaner and Thermal Regenerator

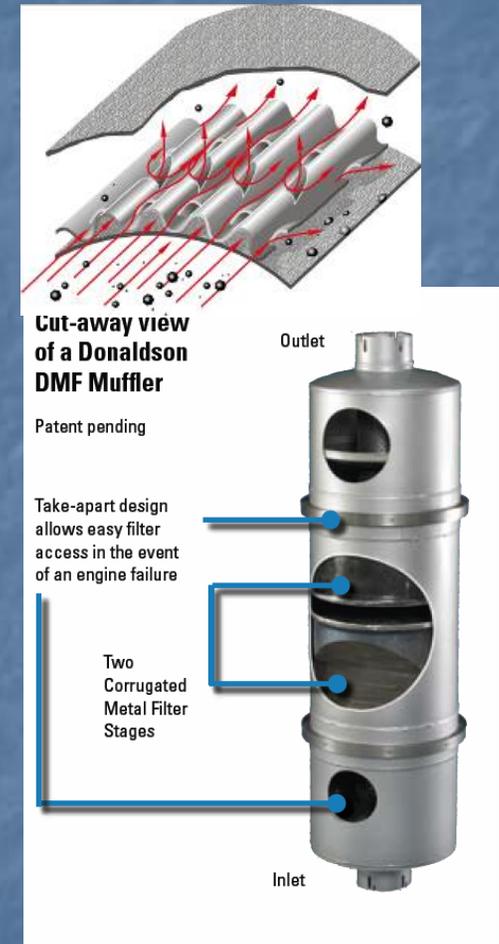
Diesel Oxidation Catalysts (DOC)

- Flow-through technology
- 20-40 % PM reduction
- Very reliable; no temp limits
- Operates with any fuel
- Direct-replacement mufflers (CCM)
- 1-1.5 hr installation time
- Maintenance free



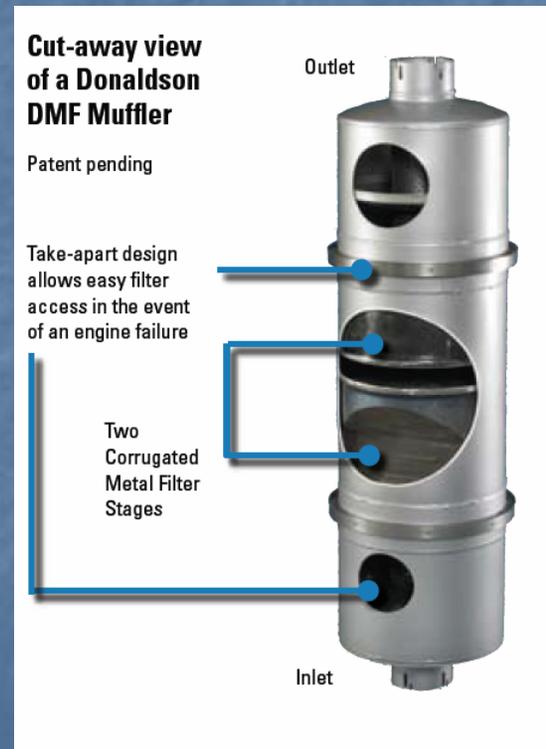
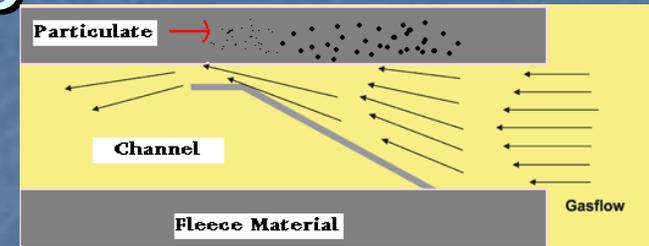
Diesel Multi-stage Filter (DMF)

- Flow through filter
- DMF is a California Air Resource Board (CARB) Level 2 Verified Device
- Up to 60% PM reduction
- Maintenance Free design, no ash cleaning

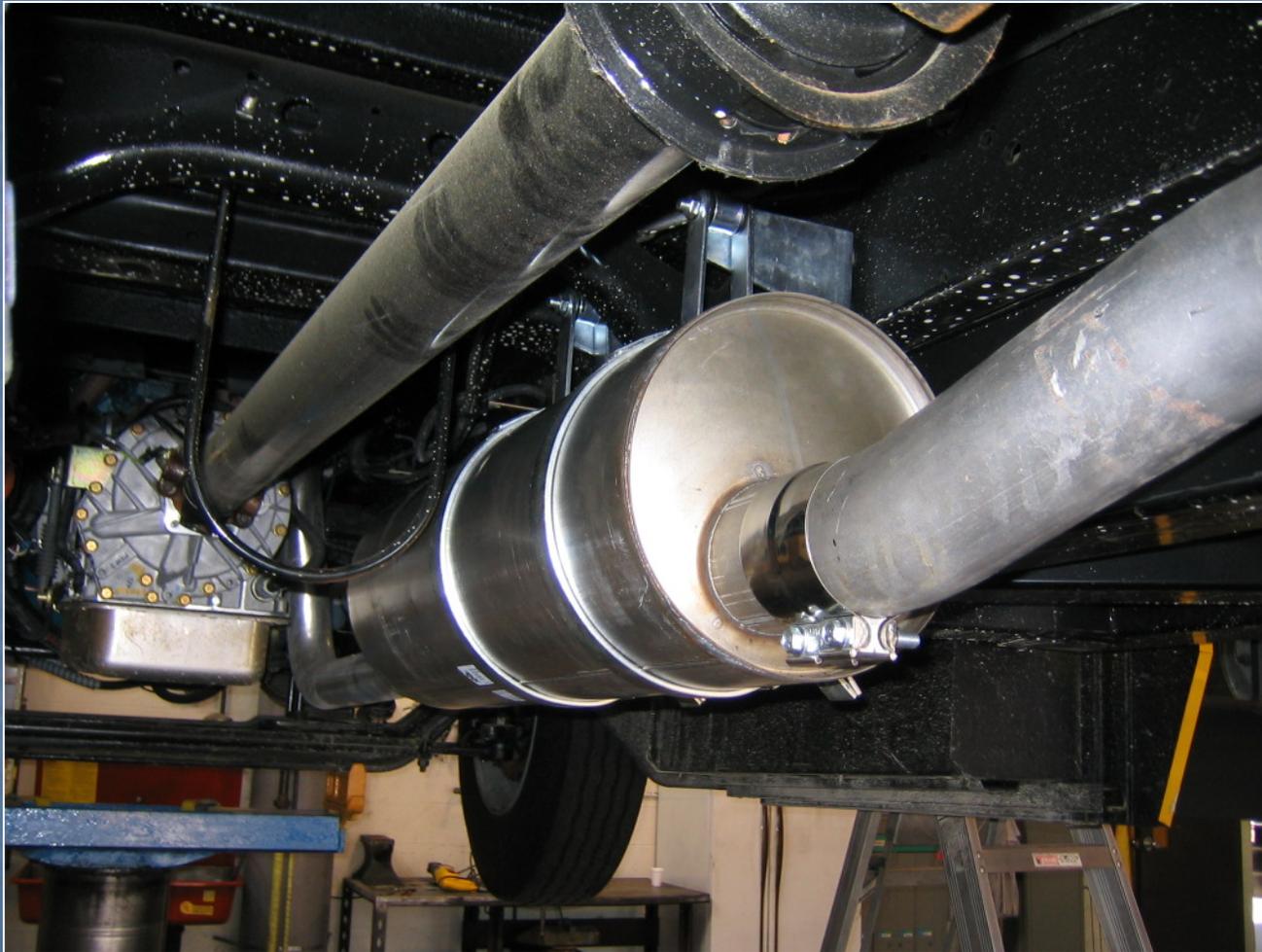


DMF Design

- DMF does not require a backpressure monitor kit
- DMFs can operate at a lower exhaust temperature than the DPF's -210c @ 40%
- DMF are easy to install-1-2 hours

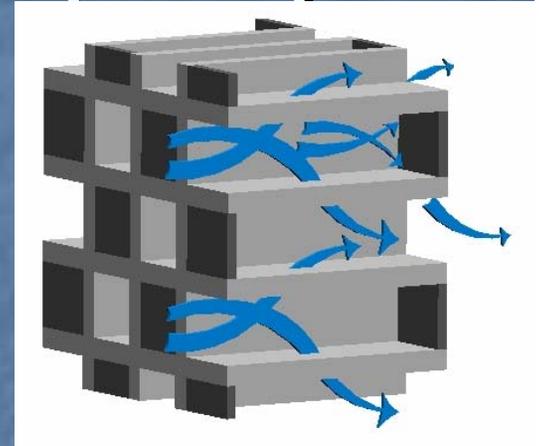


DMF Installation Example



Diesel Particulate Filter (DPF)

- Level 3 Device
- Wall flow technology
- 85+ % PM reduction
- Data-log Required
- Requires ULSD fuel
- 2-3 hr installation time
- Ash cleaning required annually
- No needed gaskets



DPF Cleaning System



Pulse
Cleaner

Thermal
Regenerator

- Two-stage Approach
 - 1st Stage Pulse Cleaner
 - 2nd Stage Thermal Regenerator

Helpful Websites

- www.deq.state.mi.us
- www.epa.gov/otaq/retrofit/verif-list.html
- www.eere.energy.gov/cleancities/
- www.epa.gov/midwestcleandiesel/
- www.dieselforum.org

Contact Information

- Zach Park
- Cell- 313-268-1408

- E-mail
- zpark@wwilliams.com