Diesel Solutions – Retrofit Technologies for North Carolina

There have been dramatic improvements in diesel technologies in recent years. Beginning in 2007, on-highway diesel engines will increasingly reduce emissions thanks to the expanded use of ultra-low sulfur fuel and advanced engine technologies. Similarly, the U.S. Environmental Protection Agency's (EPA) recently released Non-road Diesel Rule will phase in emission reductions for construction, agricultural and industrial diesel-powered equipment.

Even with these new diesel emission standards, there is a need to find solutions to clean up the older diesel engines that will remain on the road. This is especially true because of slow diesel fleet turnover.

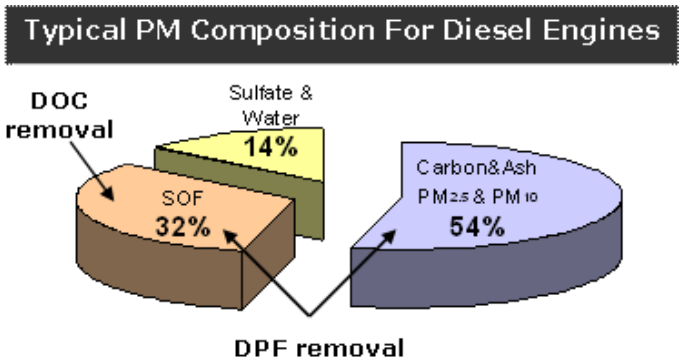
- **The average lifespan of a heavy duty diesel vehicle can range from 20-30 years**.
- There are currently 11 million diesel vehicles on U.S. roads.

Harmful Effects of Diesel Emissions

Diesel emissions contain nitrogen oxides, particulate matter and hydrocarbons that contribute to **ground level ozone** and **fine particulate pollution**, problems that affect many metropolitan areas including those in North Carolina. Twenty-four counties (or portions of counties) in North Carolina are currently non-attainment or maintenance areas for national ambient air quality standards (NAAQS) for ozone and/or fine particulates.

Diesel exhaust emissions have also been extensively studied to determine the **health risks** of these emissions. Many studies have linked diesel exhaust as a possible human carcinogen, as well as with acute and chronic respiratory effects.

Retrofit Technologies – Overview and Benefits



<u>Diesel Particulate Filter (DPF):</u>

DPFs are ceramic devices that collect particulate matter (PM) in the exhaust stream. The high temperature of the exhaust heats the ceramic structure and allows the particles inside to break down (or oxidize) into less harmful components.

- DPFs can be installed on new and used buses and trucks, but must be used in conjunction with ultra-low sulfur diesel (ULSD). ULSD, fuel with a sulfur content of less than 15 parts per million, is now widely available from distributors and at retail locations. However, all highway diesel is not required to be replaced by ULSD until December 1, 2010.
- The combination of DPFs and ULSD can reduce emissions of particulate matter, hydrocarbons, and carbon monoxide by **60 to 90 percent**. *(Source: EPA)*
- DPFs work best on engines built after 1995.

<u>Diesel Multi Stage Filter (DMF):</u>

A DMF is a two stage metallic filter used to trap and reduce PM. Each filter stage consists of alternating layers of a corrugated metal and a porous sintered metal fleece. DMFs reduce PM, hydrocarbons and carbon monoxide emissions by **50 percent** and nitrogen oxide emissions by 20 percent. *(Source: CARB)*

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Diesel Oxidation Catalyst (DOC):
Diesel oxidation catalysts (DOCs) are devices that use a chemical process to break down pollutants in the exhaust stream into less harmful components. DOCs **only remove the soluble organic fraction, not the elemental carbon of PM_{10} or $PM_{2.5}$**. With ULSD widely available, DOCs should only be considered when vehicles are not good candidates for DPFs, because they are less effective at emission reduction.

- Particulate matter is reduced by **20 percent**, hydrocarbons by 50 percent and carbon monoxide by approximately 40 percent with the use of DOCs. *(Source: EPA)*
- DOCs can be installed on on-road and off-road diesel engine and run on regular diesel fuel.

Close Crankcase Ventilation (CCV):
A CCV reduces emissions of hydrocarbons and particulate matter produced from the engine crankcase or oil pan area. Typically, CCV technology is **combined with a DPF or DOC**.

Maintenance and Costs

EPA estimates the following costs for retrofit technologies:

Retrofit Technology:	Estimated Cost:
Diesel Particulate Filters	$5,000-$10,000
Diesel Multi Stage Filter	$4,000-$6,000
Diesel Oxidation Catalysts	$600-$2,000
Close Crankcase Ventilation	$400-$600

Both DPFs and DMFs can only be used with ULSD.

Most DPFs require annual cleaning after installation. Cleaning can be done onsite with specialized equipment or a filter can be swapped out and sent for cleaning with the manufacturer. See individual manufacturer for more information. DMFs, DOCs and CCVs require little to no maintenance.

Resources

The EPA and the California Air Resources Board (CARB) have verification processes for the approved use of diesel retrofit technologies;

For **EPA verified technologies** visit: www.epa.gov/otaq/retrofit/retroverifiedlist.htm.
For **CARB verified technologies** visit: www.arb.ca.gov/diesel/verdev/vt/cvt.htm

Below are verified technology vendors that serve the North Carolina market:

Brett Alkins
Caterpillar Emissions Solutions
309-578-1869
alkins_brett_d@cat.com

David Secord
Engine Control Systems
905-952-2439
dvsc@enginecontrolsystems.com

Mike Zimovan
Donaldson Company, Inc.
803-767-7158
mzimovan@Mail.Donaldson.com

Roger Kuchar
International Truck Engine Corp
630-753-6217, 847-727-6437 (m)
roger.kuchar@nav-international.com

Tom Swenson
Cleaire Horizon
916-689-0248, 800-308-2111
Tom.swenson@cleaire.com

Glen Reid
Clean Diesel Technologies
203-327-7050, 203-376-6678 (m)
greid@cdti.com

For more information about diesel retrofit technologies and grant programs, please visit:

Clean School Bus USA	www.epa.gov/otaq/schoolbus/index.htm
Diesel Technology Forum	www.dieselforum.org
Southeast Diesel Collaborative	www.southeastdiesel.org

Contact the following groups for more information:

NORTH CAROLINA SOLAR CENTER **(919) 513-7831**

Triangle Clean Cities Coalition **(919) 558-9400**

Centralina Clean Fuels Coalition **(704) 348-2707**

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