

## Diesel Solutions – Retrofit Technologies



### BACKGROUND – DIESEL EMISSION STANDARDS

There have been dramatic improvements in diesel technologies in recent years. By 2007, on-highway diesel engines will produce near-zero emissions thanks to cleaner fuels and advanced engine technologies. Similarly, the EPA's recently released Nonroad Diesel Rule will phase in reductions from construction, agricultural and industrial diesel-powered equipment.

Even with these new diesel emission standards, diesel fleet turnover is slow and many older diesel engines will continue to run for years to come. The **average lifespan of a heavy duty diesel vehicle can range from 20-30 years**. This emphasizes the need to find solutions to clean up these older diesel engines that will remain on the road. Retrofit technologies are just that – pollution control equipment that can be used on existing diesel engines to reduce harmful emissions.

### 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 fine particulates.

Diesel exhaust emissions have also been studied extensively 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. Diesel exhaust can have the most harmful effect on certain vulnerable populations, including: children, elderly and individuals with asthma or other pre-existing respiratory conditions.

### RETROFIT TECHNOLOGIES

The two most common pollution control devices to reduce diesel exhaust emissions on existing engines are **diesel particulate matter filters (DPF)** and **diesel oxidation catalysts (DOC)**:

#### Diesel Particulate Matter Filters:

Diesel particulate matter filters are ceramic devices that collect particulate matter 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.

- Diesel particulate matter (PM) filters can be installed on new and used buses and trucks, but must be used in conjunction with ultra-low sulfur diesel (ULSD) - fuel with a sulfur content of less than 15 parts per million.

\*\*\*ULSD is available at retail locations after October 15, 2006, however, all highway diesel is not required to convert to ULSD until December 1, 2010.



**DRAFT – November 2006**

*The Clean Fuel Advanced Technology project is sponsored by the NC Department of Transportation, NC Division of Air Quality, and State Energy Office with support from the NC Solar Center, Triangle J and Centralina Councils of Governments*



- The combination of PM filters and ULSD can reduce emissions of PM, hydrocarbons (HC), and carbon monoxide (CO) by **60 to 90 percent**. (Source: EPA)
- PM filters work best on engines built after 1995.

### Diesel Oxidation Catalysts:

Diesel oxidation catalysts 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<sub>10</sub> or PM<sub>2.5</sub>**. With ULSD widely available, DPFs should be considered first over DOCs because of their superior effectiveness. If the vehicles are not good candidates for DPFs then DOCs should be considered.

- Diesel oxidation catalysts can reduce emissions of PM by **20 percent** and HC by 50 percent and CO by approximately 40 percent. (Source: EPA)
- Oxidation catalysts can be installed on any new or used buses and trucks, and run on regular diesel fuel.

### Close Crankcase Ventilation (CCV):

A CCV technology should when possible be **combined with a DPF or DOC**. A CCV reduces emissions of HC and PM produced from the engine crankcase, or oil pan area.

## MAINTENANCE

Most DPFs require regular cleaning after installation, usually on an annual basis depending on the manufacturer. 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 maintenance recommendations for more information. DOCs require little to no maintenance.

## ESTIMATED COSTS

EPA estimates the following costs for retrofit technologies:

Retrofit Technology:	Estimated Cost:
Diesel Particulate Matter Filters	\$5,000-10,000
Diesel Oxidation Catalysts	\$600-\$2,000
Close Crankcase Ventilation	\$400-\$600

## RETROFIT MANUFACTURERS

EPA has a verification process for the approved use of diesel retrofit technologies. Most grant programs will require that the retrofit technology is EPA approved. For a list of **EPA verified technologies** see: <http://www.epa.gov/otaq/retrofit/retroverifiedlist.htm>

## RESOURCES

There are a number of grant programs available for fleets interested in reducing diesel emissions - the following resources will give an overview of several of these **grant programs**:

*Clean Fuel Advanced Technology - contact one of the following groups for more information:*

- NC Solar Center [www.ncsc.ncsu.edu](http://www.ncsc.ncsu.edu)
- Triangle Clean Cities Coalition [www.triangletcleancities.org](http://www.triangletcleancities.org)
- Centralina Clean Fuels Coalition [www.4cleanfuels.com](http://www.4cleanfuels.com)

*Clean School Bus USA* [www.epa.gov/otaq/schoolbus/index.htm](http://www.epa.gov/otaq/schoolbus/index.htm)  
*NC Division of Air Quality* [www.ncair.org/motor/ms\\_grants/](http://www.ncair.org/motor/ms_grants/)