

Clean and Green

Clean Diesel Construction Technologies and Practices



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Clean Diesel Construction

□ Why Clean Diesel?

- Reducing diesel emissions is one of our country's most important air quality challenges
- Diesel engines are the workhorses of the nation; these diesel engines emit large amounts of NO_x, PM and air toxics
- Diesel emissions are linked to premature deaths, asthma attacks, lost work days, and other health impacts every year
- Clean diesel projects offer immediate public health and air quality benefits

Clean Diesel Construction

□ Diesel Exhaust Composition

■ Smog-forming pollutants

- Nitrogen oxides (NO_x)
- Volatile organic compounds (VOC)

■ Hazardous Air Pollutants (HAPs), or Air Toxics

- 1,3-Butadiene
- Formaldehyde
- Others

Clean Diesel Construction

□ Particulate Matter (PM)

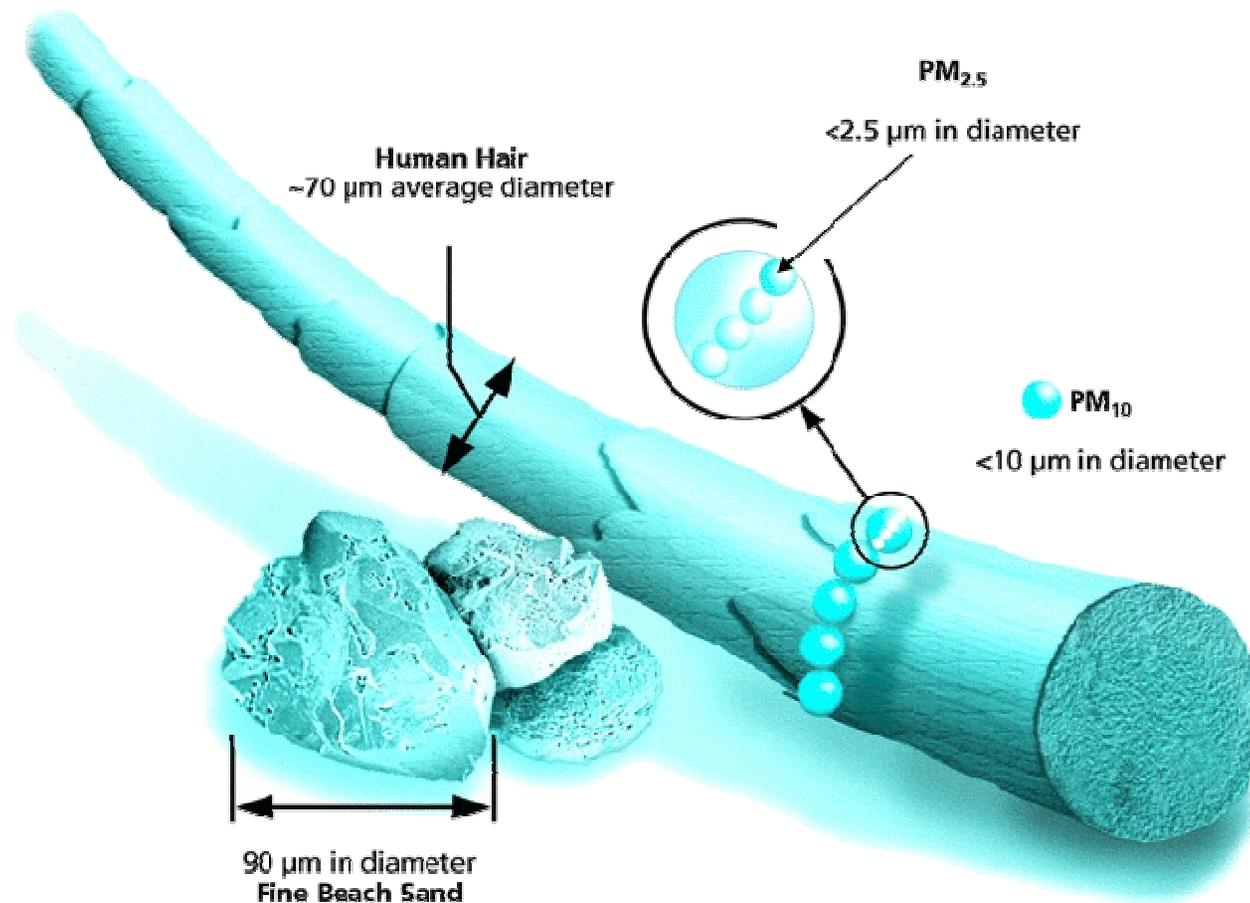


Image courtesy of EPA, Office of Research and Development

Clean Diesel Construction: Health Effects

- Ground-level Ozone (smog) and PM
 - Respiratory effects (lung irritation, difficulty breathing, etc.)
 - Increased incidence of asthma
- Particulate Matter (PM)
 - Cardiovascular effects (increased risk of heart attacks)
 - “Likely human carcinogen”
- Air Toxics
 - Increased cancer risk associated with prolonged exposure

Clean Diesel Construction: Black Carbon

- Black Carbon (Soot)
 - Product of Diesel Exhaust
 - Linked to Climate Change
 - The No. 2 contributor to rising global temperatures
 - Recent studies estimating that it is responsible for 18% of the planet's warming, compared with 40% for CO₂.
 - Decreasing black carbon emissions remove the warming effects of black carbon quickly
 - Increased Media Attention

Clean Diesel Construction: Cost/Benefit

- Costs for Society
 - \$Billions in healthcare per year related to PM exposure
- What are the benefits?
 - Significantly reduces harmful particulate matter and ground-level ozone precursors
 - Reduces exposure in communities and sensitive populations nearby Superfund & redevelopment sites
 - \$1 invested in diesel emissions reductions → \$13 in health benefits
 - Decrease in hospital admissions
 - Asthma attacks, heart attacks, cardiopulmonary illnesses
 - Fewer lost work and school days

Clean Diesel Construction: EPA Regulations

- Regulations imposed on the manufacturers and fuel suppliers

On-Road Vehicles & Engines		
Engine standards	90% reduction in particulate matter	Began with 2007 model year
Fuel standard	15 ppm sulfur content	Began October 2006 (80%, phased in to 100% by 2010)
Non-road Vehicles & Engines		
Engine standards	Tier 3 (NOx and HC reductions)	Phased in from 2006 to 2008
	Tier 4 (90% PM reduction over Tier 2/3)	Phased in from 2008 to 2014
Fuel standard	500 ppm sulfur content	Began in June 2007
	15 ppm sulfur content	June 2010

Clean Diesel Construction: Strategies

- Fuel-based
 - Ultra low sulfur diesel
 - Biodiesel
- Technology-based
 - Catalysts
 - Filters
- Idling Reduction
- Maintenance



Clean Diesel Construction: Fuel Options

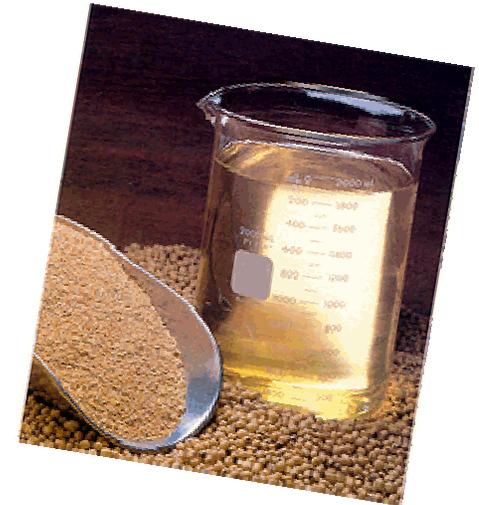
- Ultra low sulfur diesel
 - 15 ppm sulfur
 - Current standard highway fuel = widely available
 - Off-road standard in 2010 (currently 500 ppm)
 - Reduces PM



Clean Diesel Construction: Fuel Options

□ Biodiesel

- Animal or vegetable oils
- Often blended with regular diesel (B5, B20)
- Reduces PM
- ASTM D-6751
 - Several engine manufacturers have stated that blends up to B20 that conform to ASTM D-6751 will not void engine warranties



Clean Diesel Construction: Technologies

□ Diesel Oxidation Catalyst (DOC)

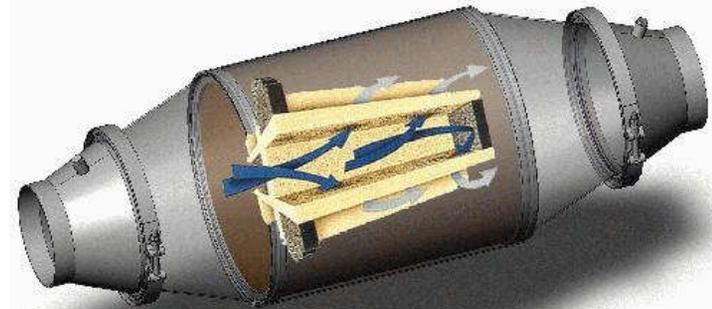
- Chemical reactions reduce the soluble fraction of diesel PM
- 20% PM reduction
- Up to 40% reduction in VOC
- Relatively low cost (under \$2,000)
- Bolt-on replacement
- Little to no maintenance



Clean Diesel Construction: Technologies

□ Diesel Particulate Filter (DPF)

- Mechanically filters particles
- 90% PM reduction
- 90% VOC reduction
- \approx \$7,000-\$12,000*
- *maybe more, depending on the amount of custom engineering
- Requires ULSD
- Passive or Active
- Some maintenance required



Clean Diesel Construction: Verified Technology

- EPA and California (MOU)
- Voluntary testing program
 - Laboratory and in-use components
 - Evaluates emission reduction capability
 - Determines a percent reduction that is recognized by EPA
- EPA requires the use of verified technologies in our grant projects

Clean Diesel Construction: Verified Technology

□ Nonroad Examples:

- Caterpillar Diesel Particulate Filter (DPF)
 - 1996-2005 turbocharged engines from 174 to 301hp

- Engine Control Systems DPF
 - Certain 1996-2004 engines

- HUSS DPF
 - Most nonroad engines through 2006

Clean Diesel Construction: “Best Available Technology”

- Determined by the type of equipment and how it operates
 - Example - DPF Requirements:
 - Proper fuel
 - Periodic cleaning to remove ash
 - Exhaust temperature high enough to burn off trapped particles (passive DPF)
 - Additional engineering to supply heat to burn off trapped particles (active DPF)

Clean Diesel Construction: Idling and Maintenance

- Idle Reduction
 - Simple
 - Cost-effective

- Proper Maintenance
 - Better performance
 - Improved fuel economy
 - Extended engine life

Clean Diesel Construction: Results

- Diesel Emissions Quantifier (DEQ)
 - Uses emission factors and information from EPA's National Mobile Inventory Model (NMIM)
 - Estimates emission reductions and cost effectiveness for clean diesel projects
 - <http://cfpub.epa.gov/quantifier>
 - Input Required:
 - Vehicle/Equipment Type, Sector, Application and Model Year
 - Retrofit Technology Type and Model Year
 - Fuel Type and Annual Fuel Usage
 - Usage Rate (hours/vehicle/year)

Editing Information for Vehicle Group 1 (V1)

Enter or edit information about this Vehicle Group.

Selected State: NY
Select type: NonRoad
Select sector: Construction Construction
Application: Excavators
Quantity: 20
Model Year: 2002
Retrofit Year: 2009
Horsepower: 175
Select fuel type: Regular Diesel (LSD), 500 ppm
Enter fuel volume: 8083 gal/yr for group
Calculated fuel volume: 8083 diesel gal/yr for group
Usage rate: 1092 hours/vehicle/year

[Click here to enter funding information.](#)

Vehicle Group Actions

Save V1

Add New

Apply a Technology to Vehicle Group 1 (V1)

Enter or edit information about the Emissions Reduction Technology.

Select technology type: Emissions Control Devices
Select technology: Diesel Particulate Filter + ULSD

This group has 20 vehicles. Enter the number of vehicles to which you would like this technology applied.

20 vehicles have Diesel Particulate Filter + ULSD.

Pollutants:	NOx	PM	HC	CO	CO2
Reduction:	<input type="text" value="0.00"/> %	<input type="text" value="90.00"/> %	<input type="text" value="90.00"/> %	<input type="text" value="90.00"/> %	<input type="text" value="0.00"/> %

Unit cost: \$

Installation cost: \$

Clean Diesel Construction: Results

Annual	NOx (tons/year)	PM (tons/year)	HC (tons/year)	CO (tons/year)	CO ₂ (tons/year)	Diesel-Equivalent (gallons/year)
Baseline of Entire Fleet	10.7273	0.9263	0.7087	2.862	67.2993	6,063.00
Percent Reduced (%)	0.00%	90.00%	90.00%	90.00%	0.00%	0.00%
Amount Reduced Per Year	0	0.8337	0.6378	2.5758	0	0
Lifetime	NOx (tons)	PM (tons)	HC (tons)	CO (tons)	CO ₂ (tons)	Diesel-Equivalent (gallons)
Baseline of Entire Fleet	10.7273	0.9263	0.7087	2.862	67.2993	6,063.00
Percent Reduced (%)	0.00%	90.00%	90.00%	90.00%	0.00%	0.00%
Amount Reduced	0	0.8337	0.6378	2.5758	0	0
Amount Emitted After Retrofit, Entire Fleet	10.7273	0.0926	0.0709	0.2862	67.2993	6,063.00

Questions?

□ Contact:

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