

# Diesel Particulate Control Technology

LADCO Presentation

March 25, 2010

# Past & Future Federal Standards



<b>Year</b>	<b>Tier Level</b>	<b>PM Standard (g/bhp-hr)</b>	<b>After-treatment Required</b>
<b>2000</b>	1	0.4	None
<b>2006</b>	2	0.15	None
<b>2011</b>	4i	0.075	DOC
<b>2015</b>	4f	0.022	DPF

# Some State Regulations - Drivers



California

Wisconsin

New York

Connecticut

- State of California

- ATCM (Airborne Toxics Control Measure):
- Stationary CI engines > 50 Hp
- Verification procedure for PM established Feb. 2004
- Regulations established for prime, emergency standby and pumping engines
- 100% compliance by January 1, 2009
- New engines must meet 0.01 g/bhp-hr PM starting January 1, 2009

# Regulations



## CA ATCM

<u>Application</u>	<u>PM Limit</u>
New prime diesel engines	< 0.01
In-use prime diesel engines that are certified off-road	85% or 0.01
In-use prime diesel engines that are not certified off-road	85% or 0.01 or 30% and 0.01 by 7/1/11
In-use emergency standby diesel engines	<b>0.15-0.40 (21-30 hrs/yr), 0.01-0.15 (31-50 hrs/yr), 0.01 (51-100 hrs/yr)</b>

## SCAQMD Rule 1470

<u>Application</u>	<u>PM Limit</u>
New emergency engines within 100 meters of a K – 12 school	0.01 (< 100 hrs/yr)
Other new emergency engines	0.15 (< 50 hrs/yr), 0.01 (51-100 hrs/yr)
Existing emergency engine within 100 meters of a school	85% reduction if < 75 hrs/yr, or 0.01 < 100 hrs/yr
Other existing emergency engines	0.4 (21-30 hrs/yr), 0.15 (31-50 hrs/yr), 0.01 (51-100 hrs/yr)

- Wisconsin – In effect 7/1/07 with compliance by 7/1/10. Diesel engines that burn >40,000 gals fuel per year
  - 100 to 750 Hp - 0.01 g/bhp-hr PM
  - >750 Hp - 0.03 g/bhp-hr PM
- New York State Proposed Subpart 222 – In effect 1/1/09 for non-emergency diesel engines >200 Hp (NYC metro) and >400 Hp (upstate)
  - 0.10 lb/mmBTU (0.115 g/bhp-hr) PM or 85% PM control
- Connecticut – General Permit requires Demand Response engines meet 90% NO<sub>x</sub> and > 85% PM reduction.

# Two Primary Technologies Address PM Reduction



- Diesel Oxidation Catalyst (DOC)
  - PM Reduction ~ 20%
  - A catalyst similar to the one on your car
  - Contains Platinum Group Metals
  
- Diesel Particulate Filter (DPF)
  - PM Reduction > 85%
  - A ceramic or metallic filter
  - Very high particulate removal efficiency



- A flow through device
- Causes minimum exhaust pressure drop
- Also provides CO and HC emission reduction
- Design based upon catalyst volume vs. reduction efficiency
- Approximately no maintenance required

# Diesel Oxidation Catalyst



- Can use 500 ppm S diesel fuel
- Proven low-cost technology
- Combined catalyst and muffler to provide sound attenuation and emission benefit
- Easy to retrofit on existing engines
- Variety of sizes and shapes for different applications

# STATIONARY DOC CONVERTERS

## Standard and Custom Sizes



# Diesel Particulate Filters



- A ceramic or metallic filter with a controlled porosity
- Causes relatively high exhaust pressure drop
- Some can provide CO and HC emission reduction
- Design based upon filter volume vs. pressure drop
- Some maintenance required

# Diesel Particulate Filters

- Most recommend use of ULSD
- Ability to regenerate particulate is critical
- In most cases an additional silencer is not required
- Easy to retrofit on existing engines
- Variety of sizes and shapes for different applications
- Should use a backpressure/temp monitor

# DPF Does Require Maintenance



- Since ash is not oxidized during the regeneration cycle, it must be periodically removed from the filter
- An increase in backpressure indicates the need for filter cleaning
- Filter systems are designed to meet the customer's demand for maximum run time between filter cleanings, through proper filter sizing to maximize ash holding capacity.

# Back Pressure/ Temp Monitor

- Diagnostic Module

- Recommended for all installations
- Continuous logging of pressure and temperature
- Programmable alarm settings



# DOC Application





# DOC Application



# DPF Application – Rock Crusher in California



	CAT 3408			CAT 3306		
	Engine Out g/hp-hr	Guaranteed g/hp-hr	Reduction %	Engine Out g/hp-hr	Guaranteed g/hp-hr	Reduction %
PM	0.2	0.045	85	0.3	0.03	85
CO	1.6	0.52	80	2.6	0.32	80

# DPF Application – Rock Crusher in California



# Emergency Generator with DPF/Silencer





# DPFs at California Ski Resort



# DPFs at a California Ski Resort



<b>Technology</b>	<b>Cost (\$/bhp)</b>
DOC	8
DPF	18