



ARB Rail Technology Symposium

Diesel Oxidation Catalyst

November 28, 2007



MotivePower, Inc.

- Formed in 1972 under Morrison-Knudsen
- Approximately 2,500 freight & passenger locomotives
- Custom locomotive manufacturing – design and build customer-specific solutions
- 700+ employees
- Engineering expertise with a long history of locomotive experience
- Major manufacturing facility

MotivePower – Main Complex



- 44 Acres
- 12 Major Buildings
- 243,050 sq. ft. Under Roof
- 17,000 Linear Feet of Track

DOC Environmental Solutions

- DOC emissions control module
 - Stand Alone
 - AESS
 - AESS with QES microprocessor control
- T2R kit – remanufactures locomotives to Tier 2 levels
 - Passenger and Freight locomotives
 - DOC Module included in package

Diesel Oxidation Catalyst Module

- Applicable for engines with turbochargers -- higher airflows improve performance
- Does not change locomotive envelope
 - Replaces existing silencer
 - Mounts to turbo output flange
- Highly cost-effective - \$1500-\$2500 / ton PM reduced
 - 3 yr project
 - Line haul application burning 175K gallons / yr

DOC Module



DOC Module



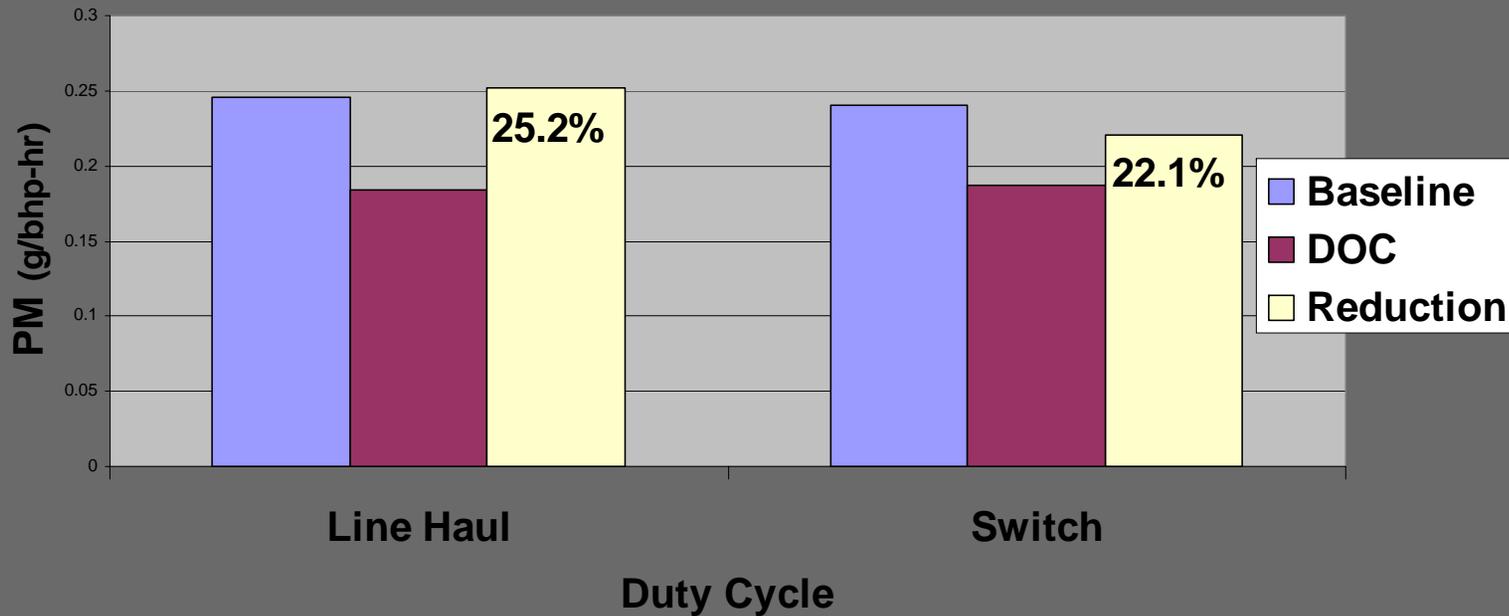
Fits inside the carbody

DOC Emissions Testing

- Test Engine: EMD 16-645F3B 3825 BHP
- Test Procedure: 40 CFR, Part 92
- Test Fuel ~2500 ppm sulfur
- Test Lab: MotivePower
- Test Period: 18 months, numerous tests

DOC Emissions Test Data - PM

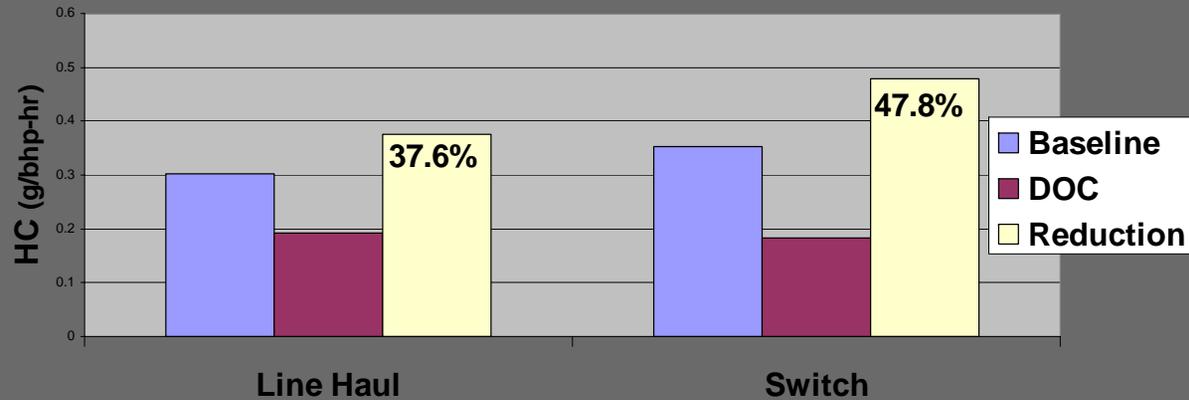
PM Reduction



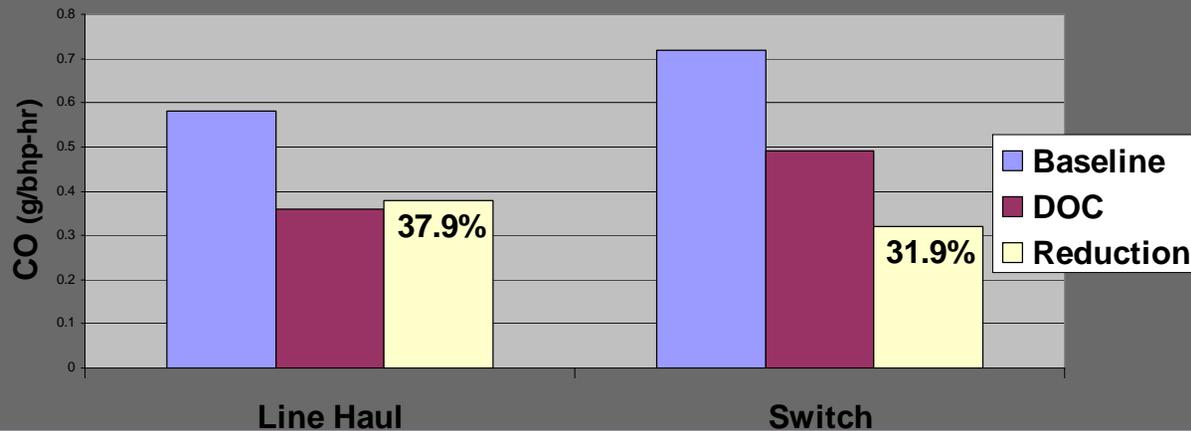
- 25-30% anticipated for low-sulfur fuels on the Switch cycle

DOC Emissions Test Data – HC & CO

HC Reduction



CO Reduction



DOC Maintenance Schedule, Projected

- Plugging Prevention
 - AESS and QES
 - Catalyst and system design
- Catalyst Cleaning
 - every 3-4 years (duty-cycle dependent)
 - Clean in place or
 - remove catalyst from casing (casing does not need to come off)
- Replacement
 - 10 yrs or more life-time projected (duty-cycle dependent)

MPI T2R Engine Upgrade Package

<u>Engine</u>	<u>HP</u>	<u>Service</u>
16-645F3B	3,600 turbo	Passenger – Line Haul
16-645E3B	3,000 turbo	Freight – Line Haul

- EPA certified for an F3B engine upgrade
- Emissions upgrade to Tier 2 levels
 - NOx: ~60% reduction 13 ⇒ 5.5 g/bhp-hr
 - PM: ~40% reduction 0.32 ⇒ 0.20 g/bhp-hr
- Upgrade package includes
 - DOC module
 - Electronic fuel injection
 - Enhanced cooling system
 - Timing adjustment

Emissions Test Lab



- MotivePower develops emission reducing technologies and obtains certifications using test lab data
- 1 of 4 test labs in North America equipped for locomotive EPA FTP

Into the Future

- Seeking field test opportunities
- Durability testing
- ARB verification and EPA certification