



# Operability and Emissions from a Medium Duty Fleet Operating With GTL Fuel and Catalyzed DPFs

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# Project Participants

- DOE's National Renewable Energy Laboratory
- South Coast Air Quality Management District
- International Truck and Engine Corporation
- Johnson Matthey
- Shell Global Solutions (US) Inc
- West Virginia University
- Yosemite Waters

# Project Objective

- To evaluate the emission performance and operability of GTL fuel and DPFs in a vehicle fleet compared to conventional diesel fuel
  - Chassis emission collection with WVU Mobile Lab
  - Evaluate impact of technology on fleet operations

# Vehicle Specifications

- Located in Fullerton, CA (metro LA)
- International engines – DT466
  - 2001 MY, 195 hp, 520 ft-lb peak torque
- 3 control vehicles and 3 test vehicles



# Fuel Properties

<b>Property</b>	<b>ASTM Method</b>	<b>GTL fuel</b>	<b>CARB spec diesel</b>
Density, g/ml	D4052	0.7850	0.8308
Cloud Point, °C	D2500	-3	-18
Sulfur, ppm	D5453	0.3	222.9
Cetane Number	D613	76	53.7
Total Aromatics, mass%	D5186	1.4	18.2
C/H ratio		2.13	1.89
HFRR Lubricity, mm	D6079	0.395	0.360
LHV, BTU/lb	D240	18,856	18,431

# Emission Control Devices

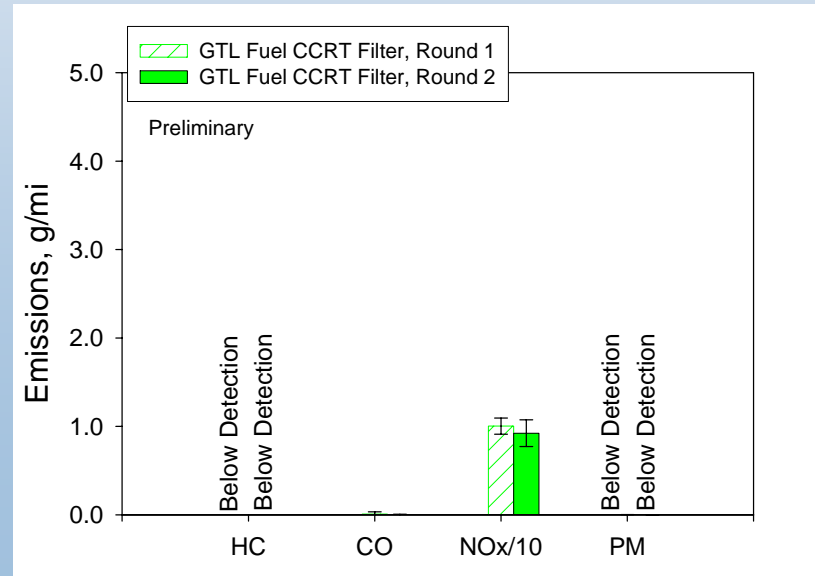
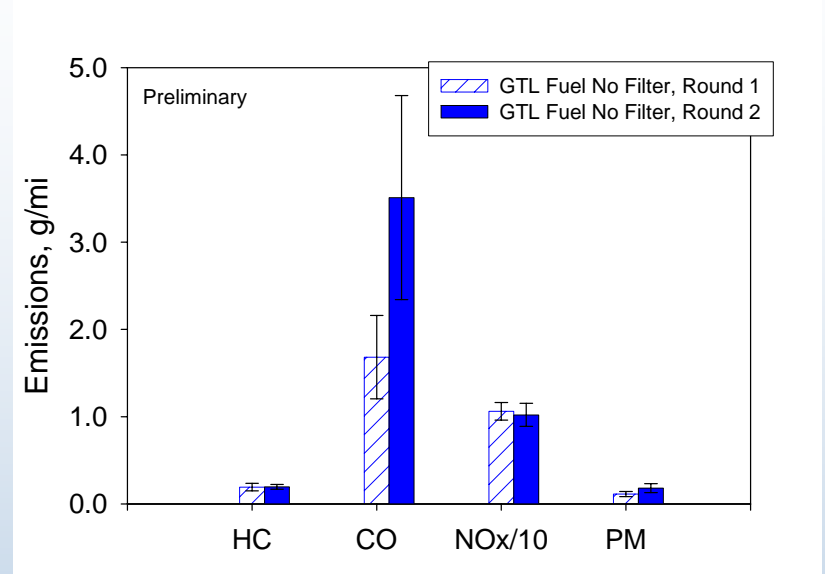
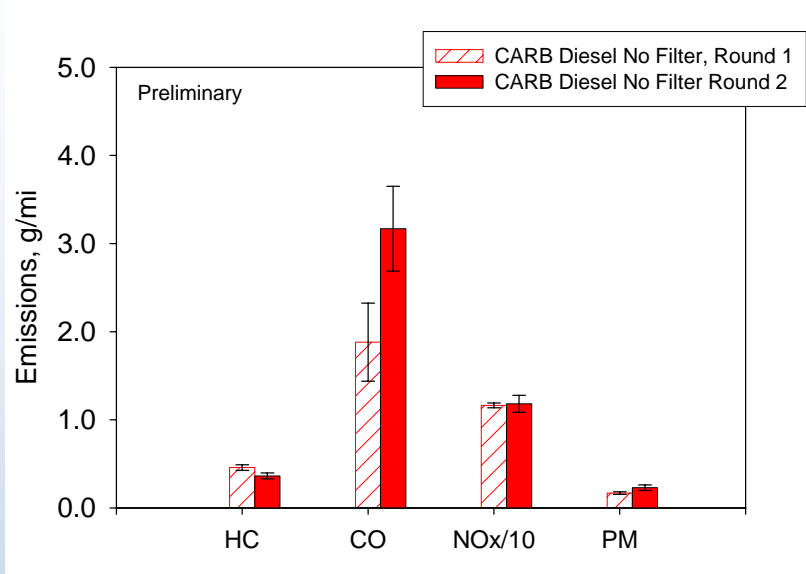
- Johnson Matthey CCRT™ technology
  - CCRT (Catalyzed CRT) is a DOC + CSF
  - EPA Verified Technology
- Effective operation at measured exhaust temperatures ~210°C
- Filters accumulated about 20,000 miles during project

# Chassis Emission Tests

- Two rounds of testing on WVU Mobile Dyno – CSHVR and NYCB cycles
- 3 vehicles tested with CARB diesel, engine out
- 3 vehicles tested with GTL fuel, engine out and with CCRT filters



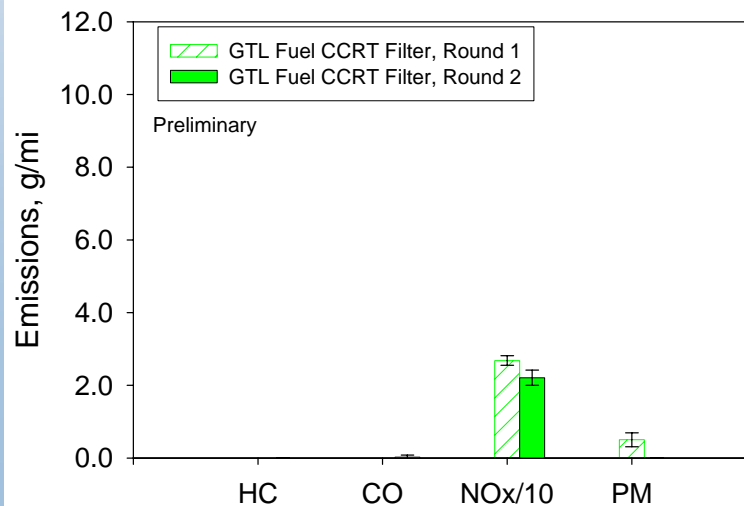
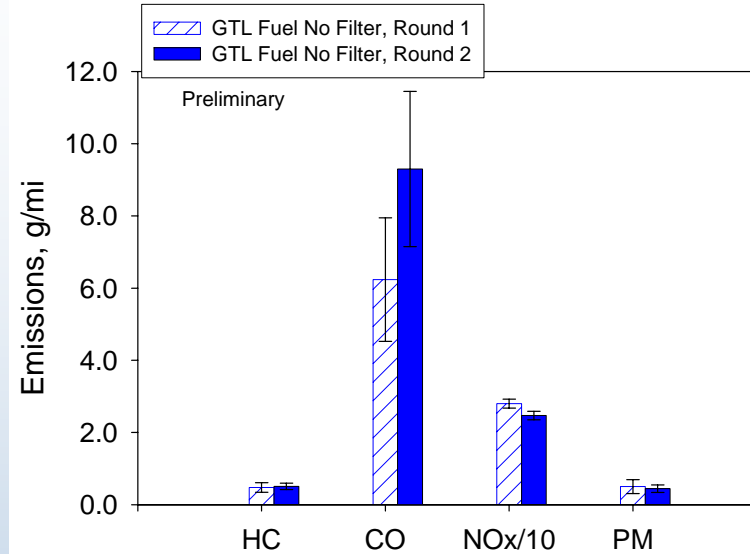
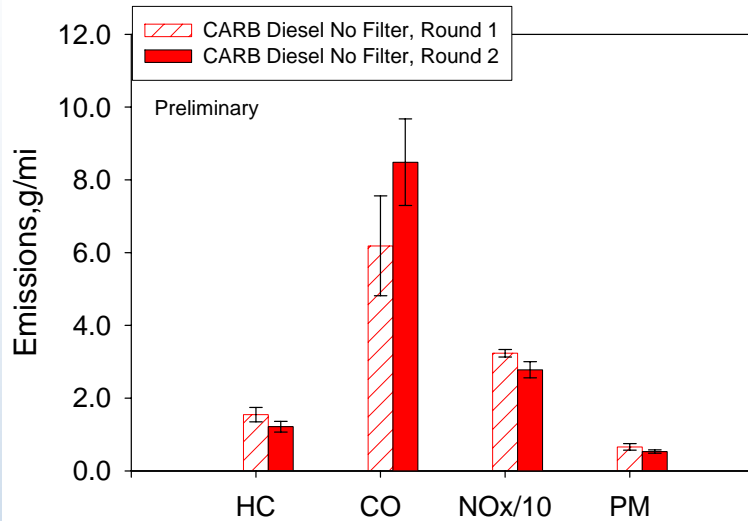
# Emission Test Results, CSHVR Cycle



Error bars are +/- 1 standard deviation



# Emission Test Results, NYCB Cycle



Error bars are  
+/- 1 standard deviation

# Percent Emission Reductions, CSHVR Cycle Compared to CARB Fuel Baseline

	Round	CO	NO <sub>x</sub>	HC	PM
GTL Fuel, No Filter	1	10.6%	8.8%	58.0%	38.8%
	2	-10.8%	13.7%	46.2%	21.1%
GTL Fuel, With CCRT Filter	1	>99%	13.8%	>99%	>99%
	2	>99%	22.0%	>99%	>99%

Statistically significant emission reduction

→ Statistical significance has not been performed on Round 2 data

# Percent Emission Reductions, NYCB Cycle Compared to CARB Fuel Baseline

	Round	CO	NO <sub>x</sub>	HC	PM
GTL Fuel, No Filter	1	-0.81%	13.4%	69.0%	23.5%
	2	-9.6%	11.1%	58.1%	15.9%
GTL Fuel, With CCRT Filter	1	>99%	17.1%	>99%	97.0%
	2	>99%	20.5%	>99%	98.8%

Statistically significant emission reduction

→ Statistical significance has not been performed on Round 2 data

# Calculated NO<sub>2</sub> Emissions

- NO<sub>2</sub> emissions measured by difference with tandem NO<sub>x</sub> analyzers
- With the GTL fuel and CCRT filters, NO<sub>x</sub> is ~50% NO<sub>2</sub>
- Increases in NO<sub>2</sub> are statistically significant compared to CARB diesel without a filter

# Fuel Economy Over Chassis Testing

- Fuel economy was not a function of fuel type or presence of filter during chassis testing
- Decrease in fuel economy observed by fleet during demonstration (still to be quantified)
  - Probably due to energy content of fuel

# Conclusions

- After ~16 months with GTL fuel and CCRT filters, operability was similar
  - No increase in seal problems, fuel line leaks, etc.
- GTL fuel and CCRT filters enabled emission reductions in HC, CO, NO<sub>x</sub>, and PM

# Acknowledgment



**U.S. Department of Energy**

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Office of FreedomCAR and Vehicle Technologies  
Fuels Technology Subprogram

South Coast Air Quality Management District