Impact of Fuel-Borne Catalysts on Diesel Aftertreatment

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DEER Conference

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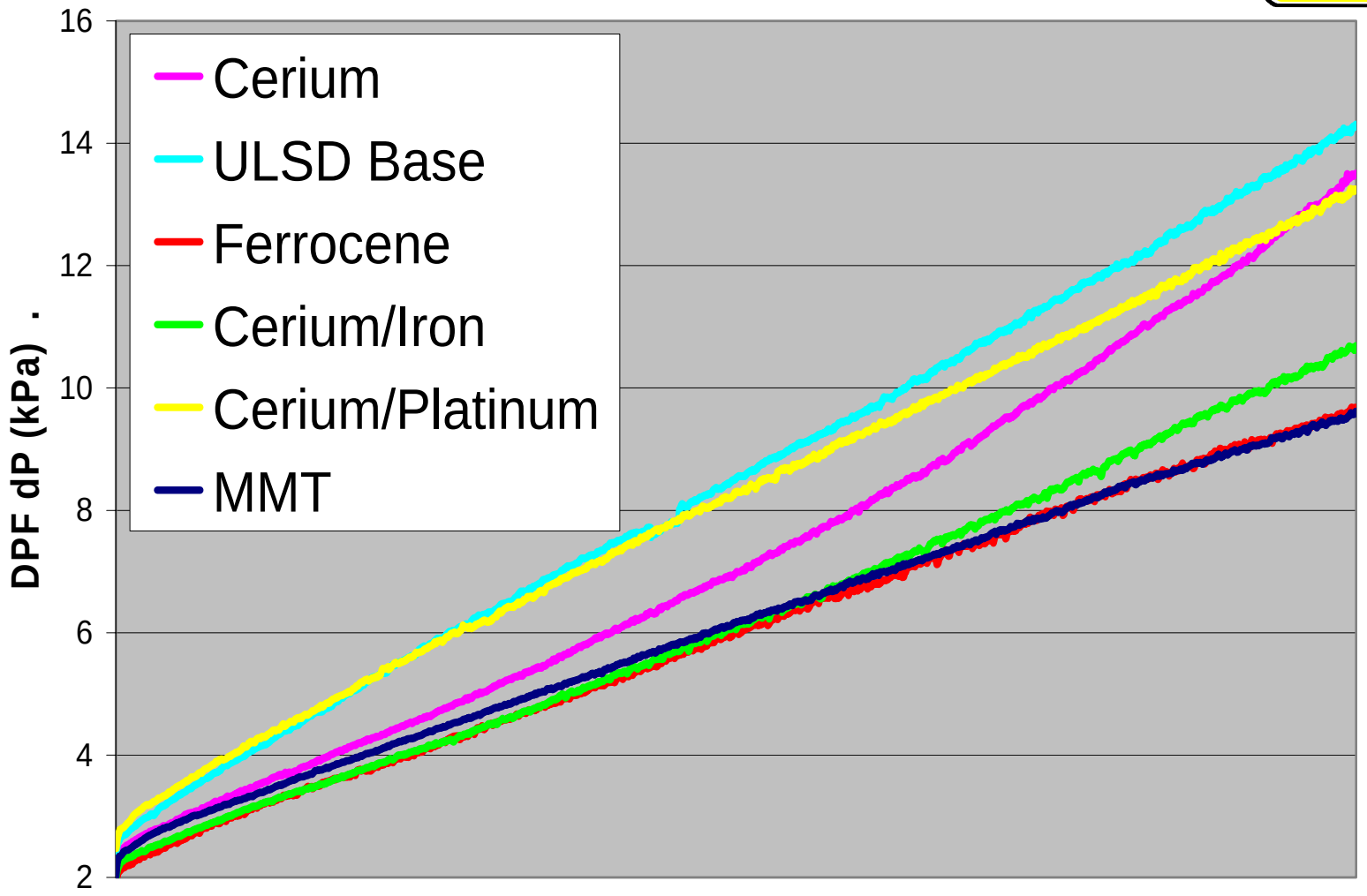
MMT Additive for Improved Performance of Diesel Aftertreatment Systems

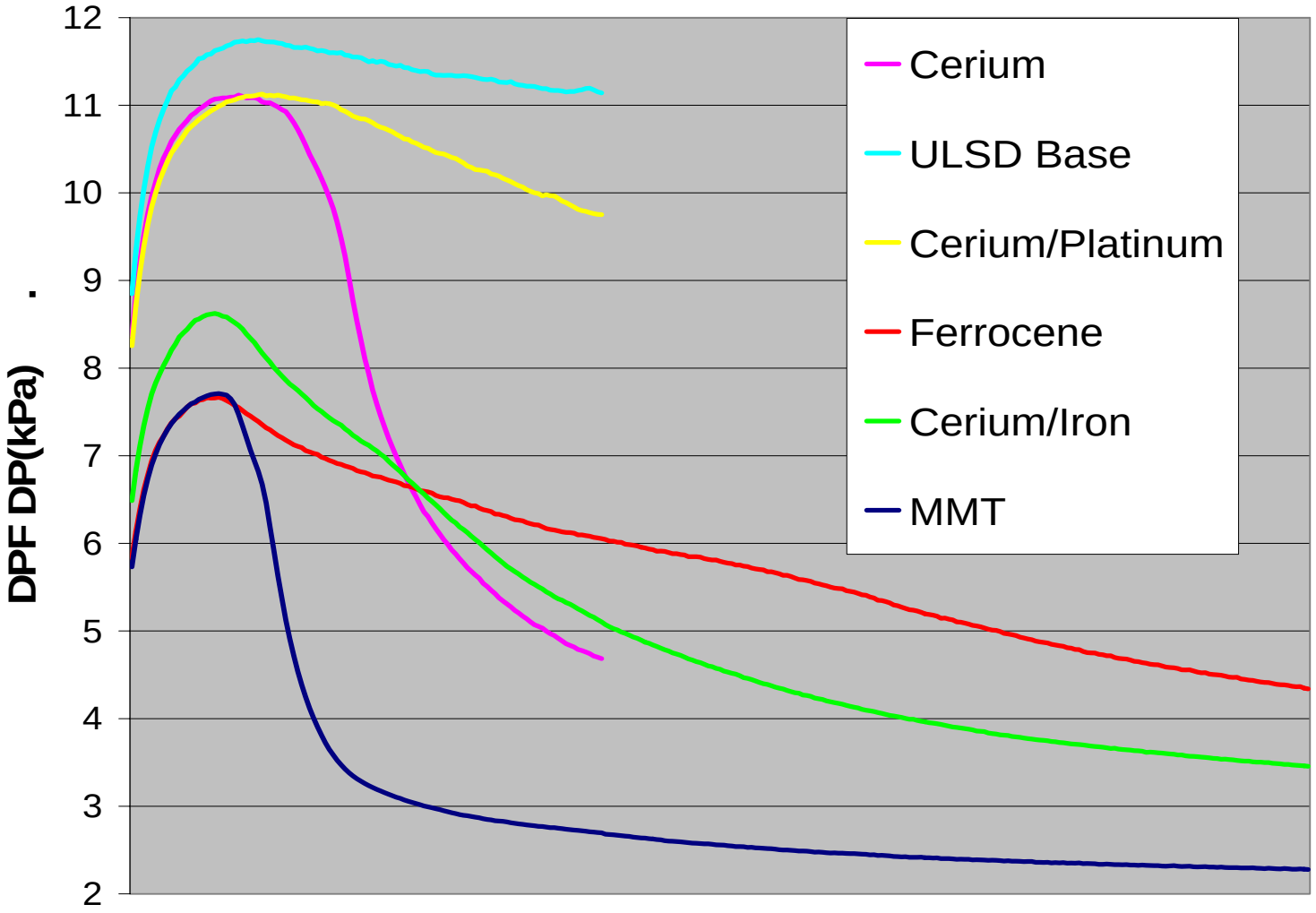
Ethyl

- Diesel Particulate Filter (DPF) with Several Fuel-Borne Catalysts
- Catalyzed DPF Project with Cummins
- Field Test Data
- Diesel NOx Adsorber Catalyst (NAC)
- Summary

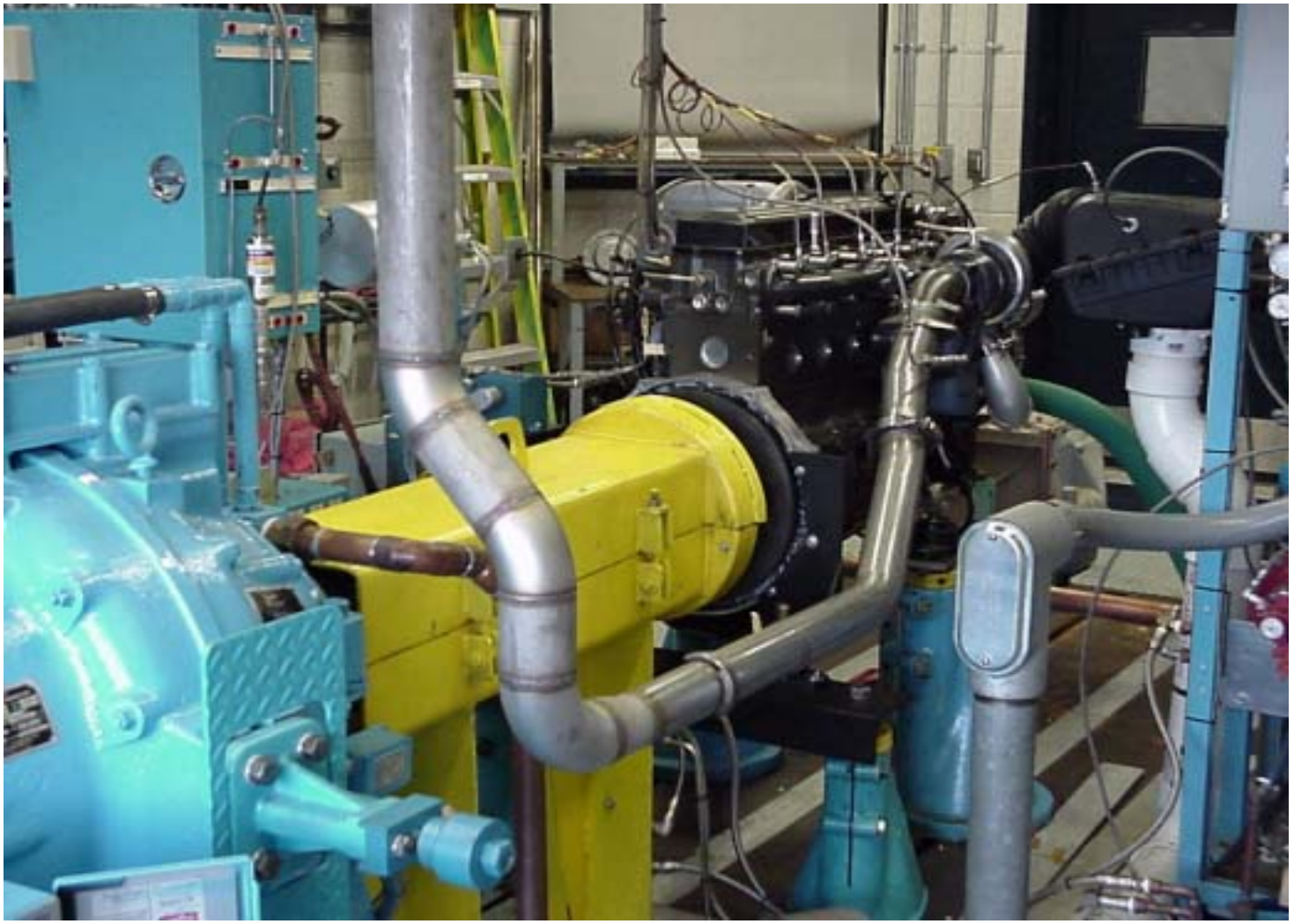
M11 Steady-State Load-up Mode



M11 - 380C Regeneration Mode

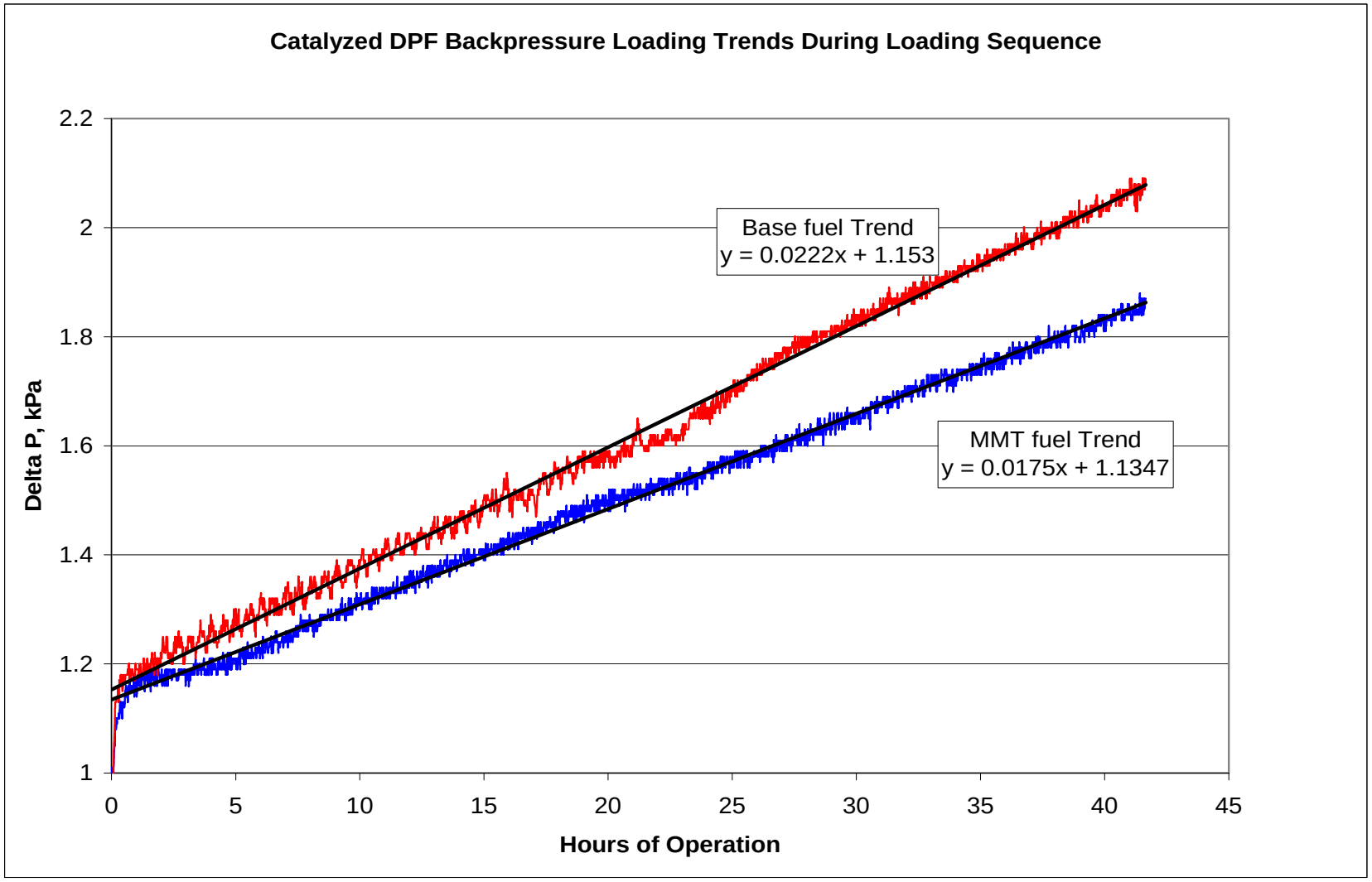


Cummins ISB 5.9 in Test Cell

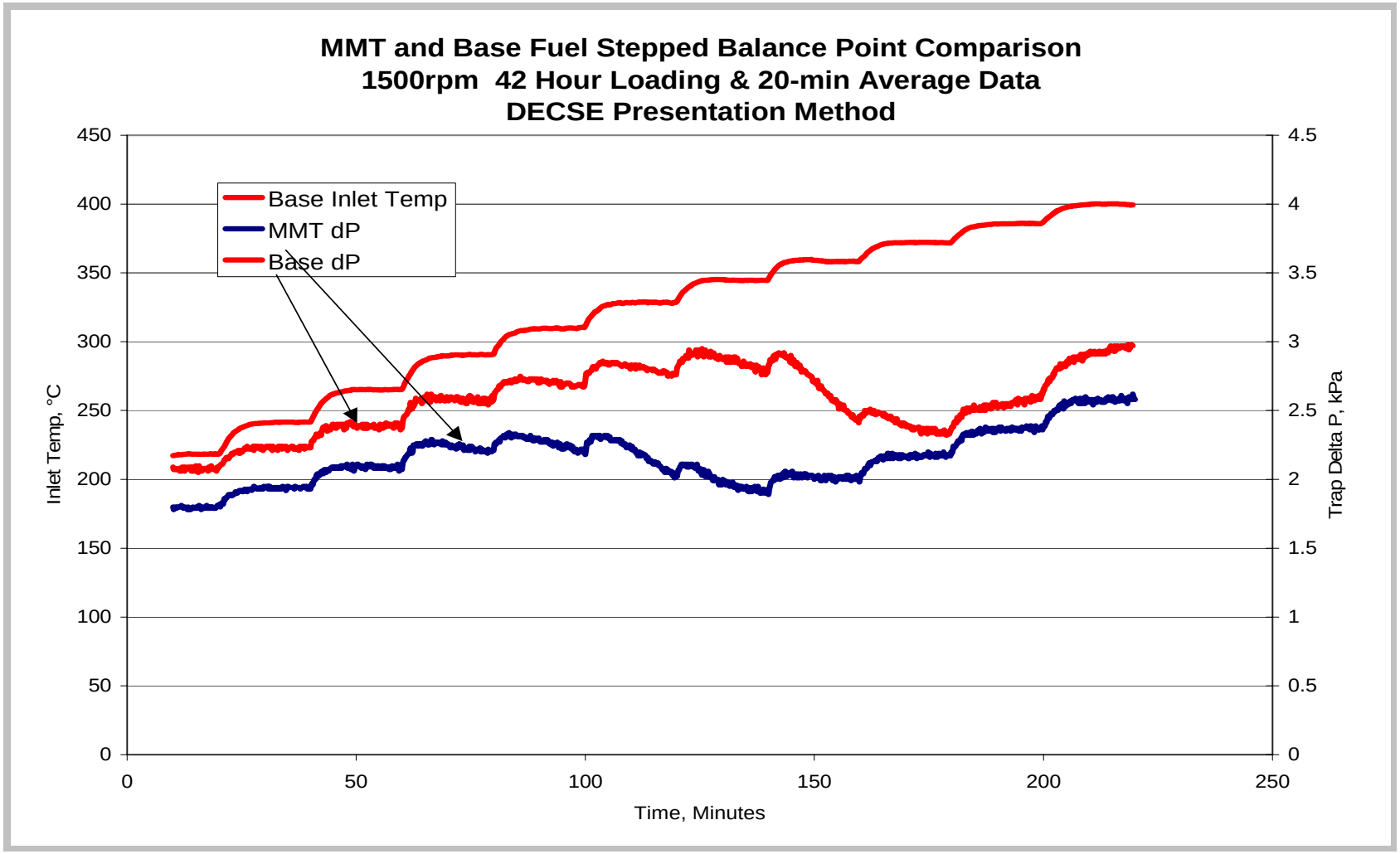


Diesel Aftertreatment Rack

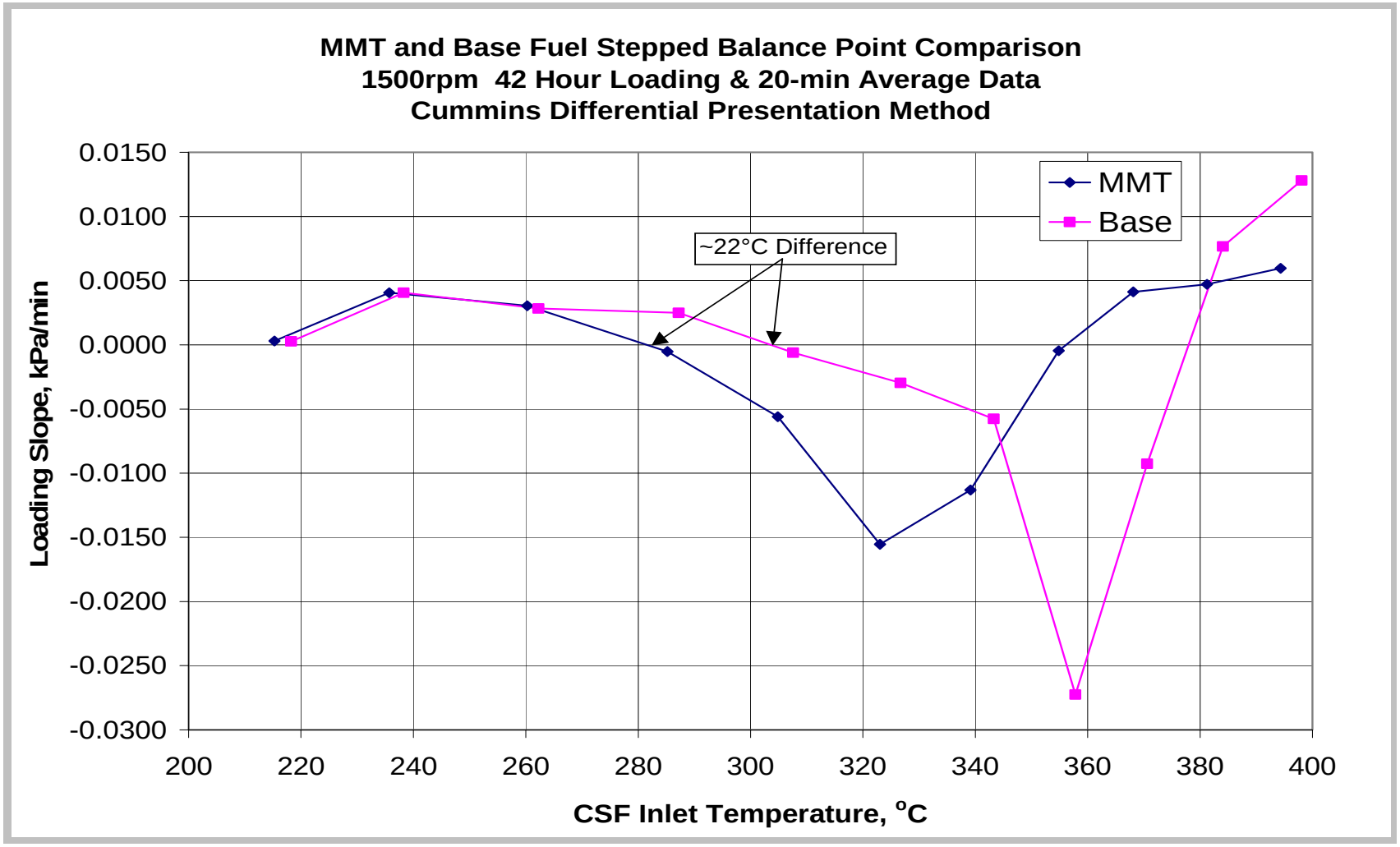
Cummins ISB Steady-State DPF Loading



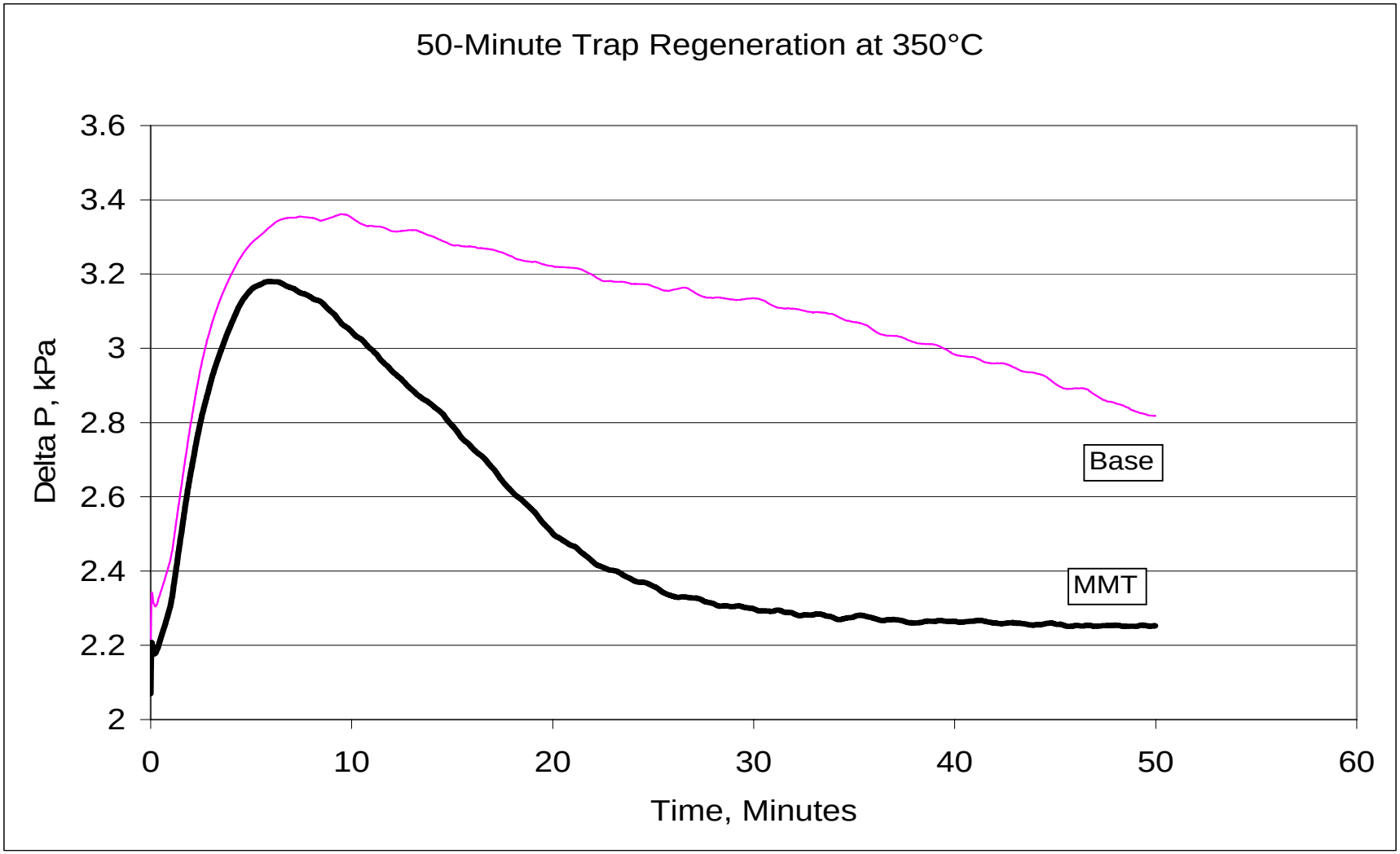
Stepped Balance Point Temp Test



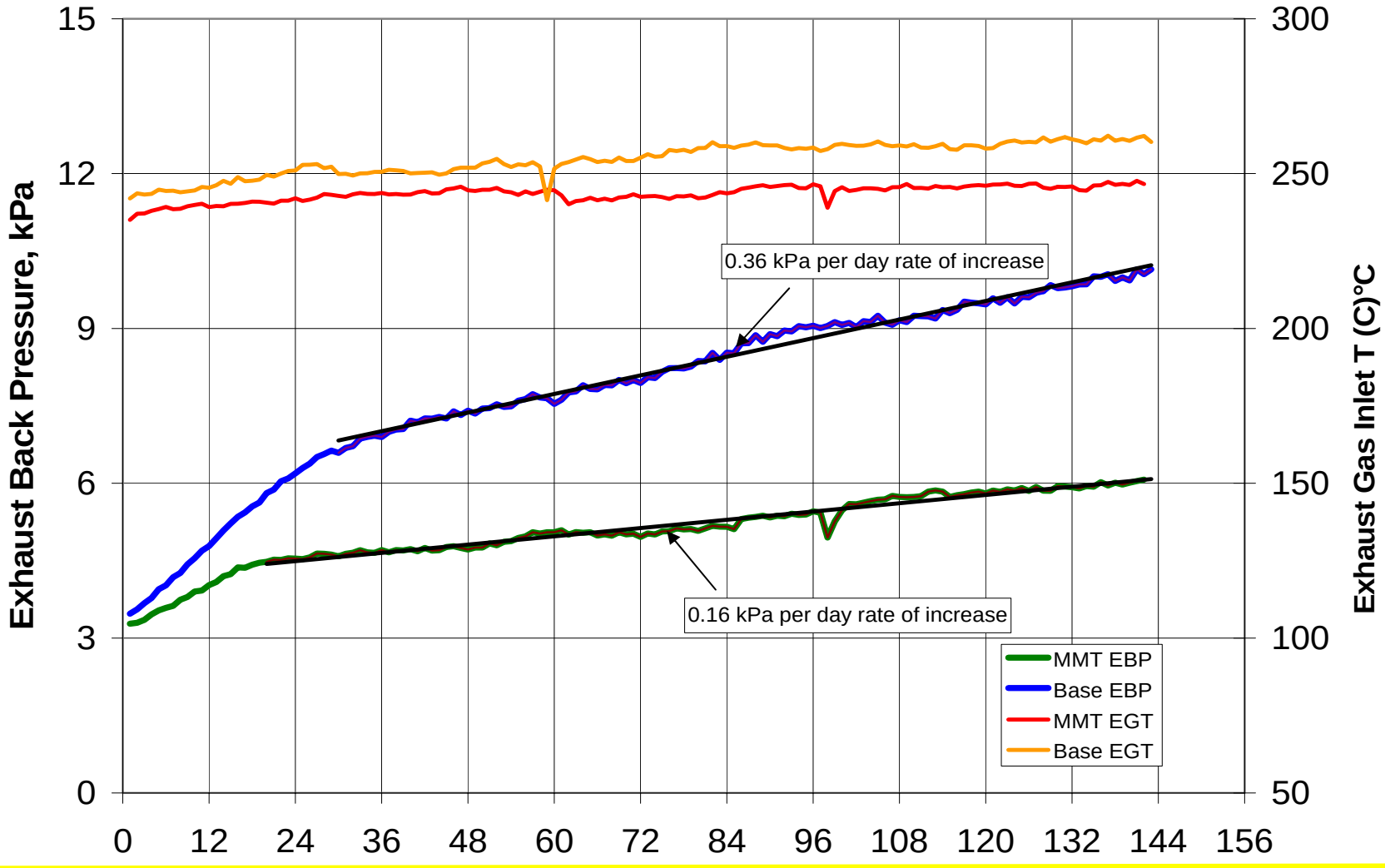
Balance Point Slope Plot



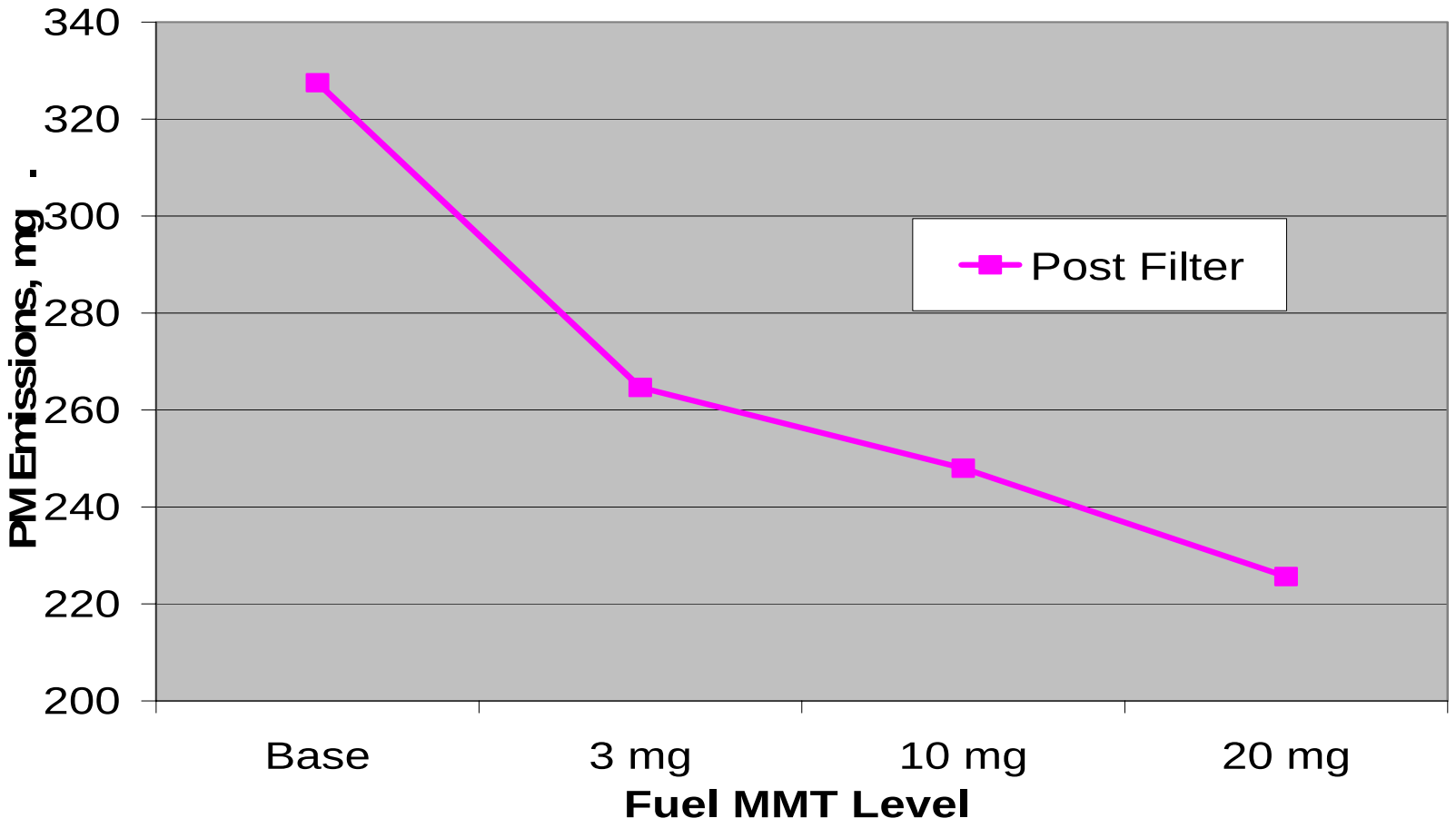
Steady-State Regeneration Mode



Cummins (Bus) Transient Cycle Loading



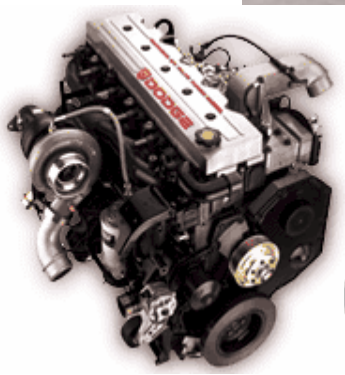
PM Emissions – Transient Cycles



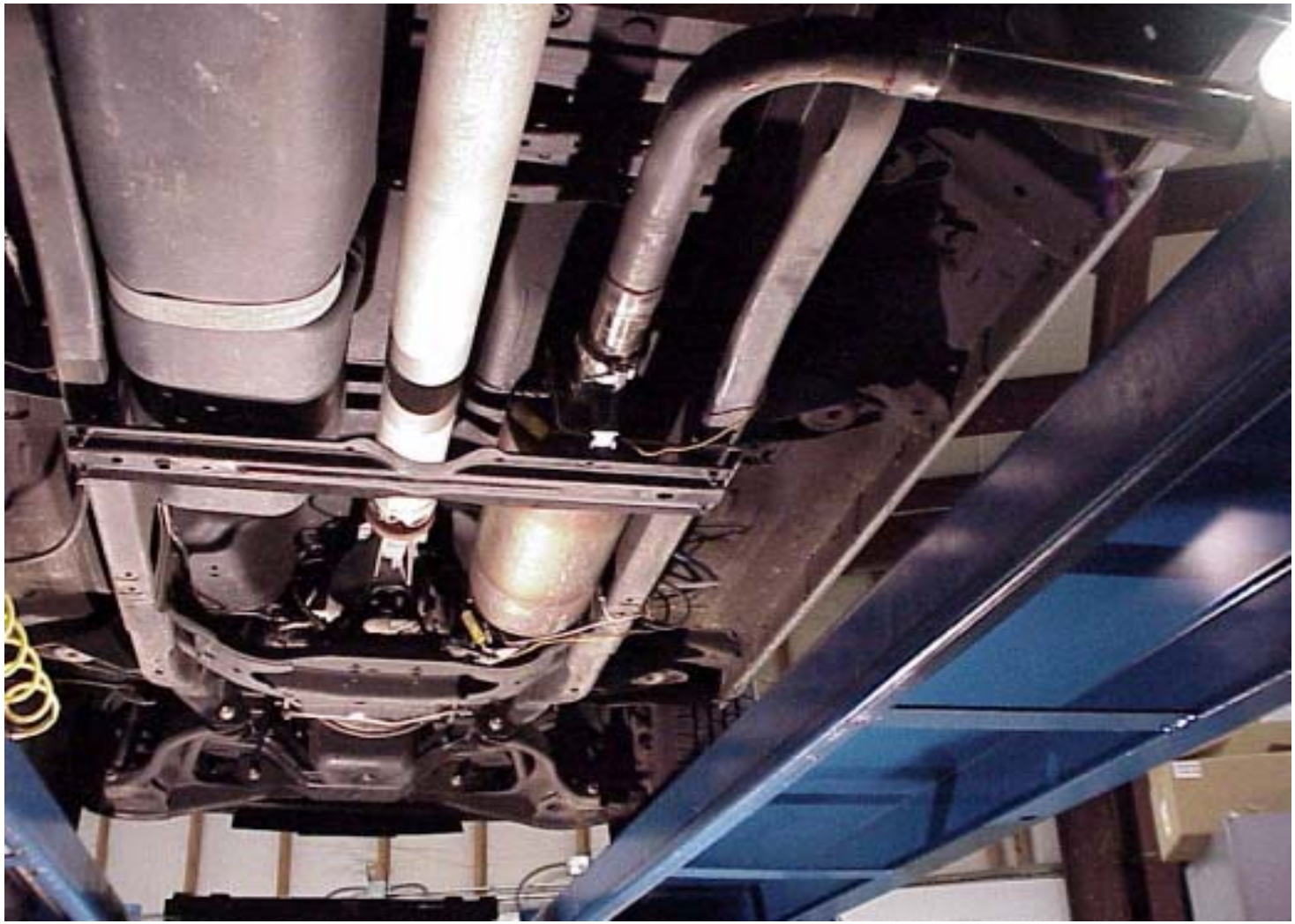
No Mn is emitted at the tailpipe when using MMT with a DPF

Dodge Ram Field Test

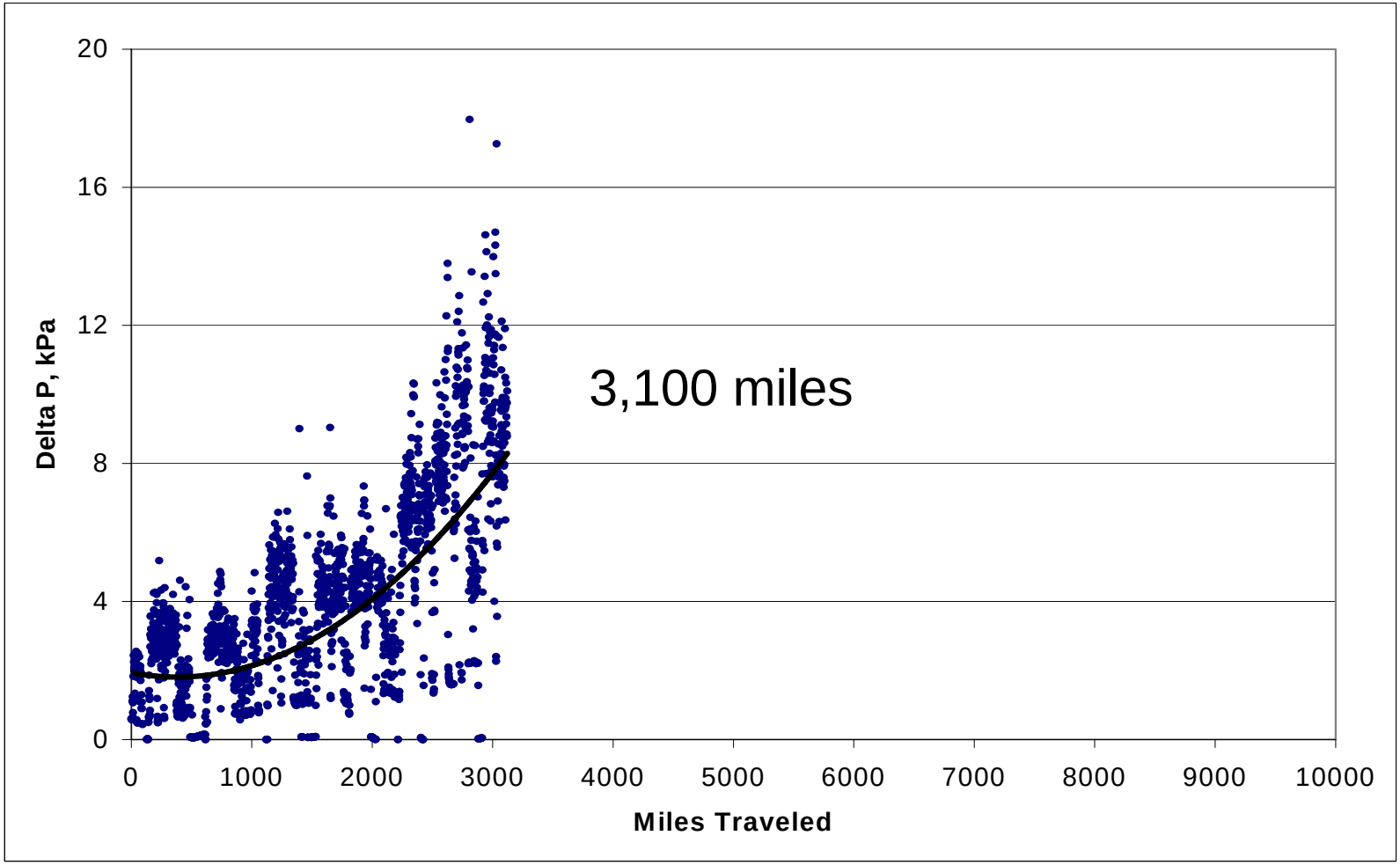
Ethyl



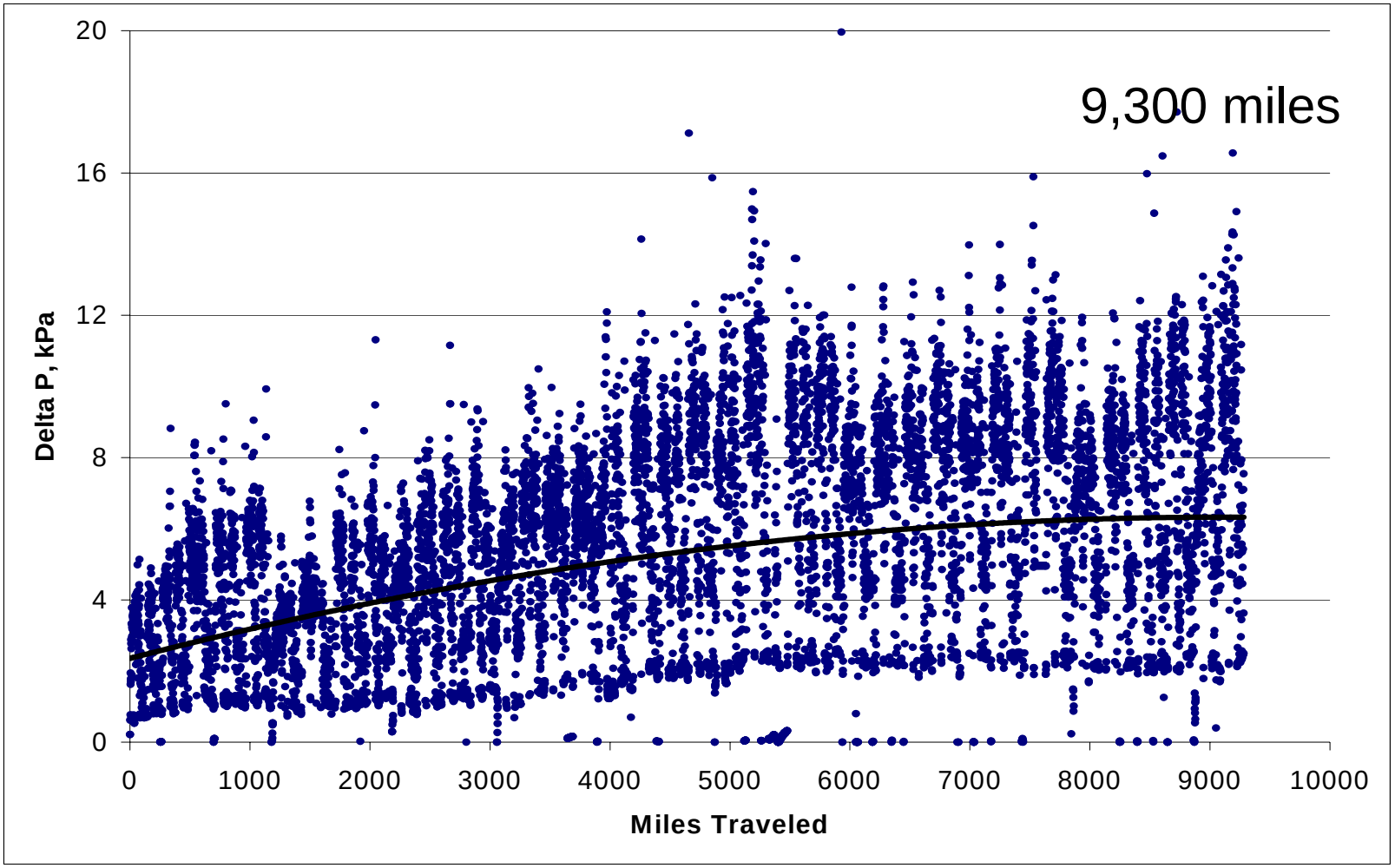
DPF Mounted Underbody



Base Fuel - Delta Pressure vs. Mileage



MMT Fuel - Delta Pressure vs. Mileage



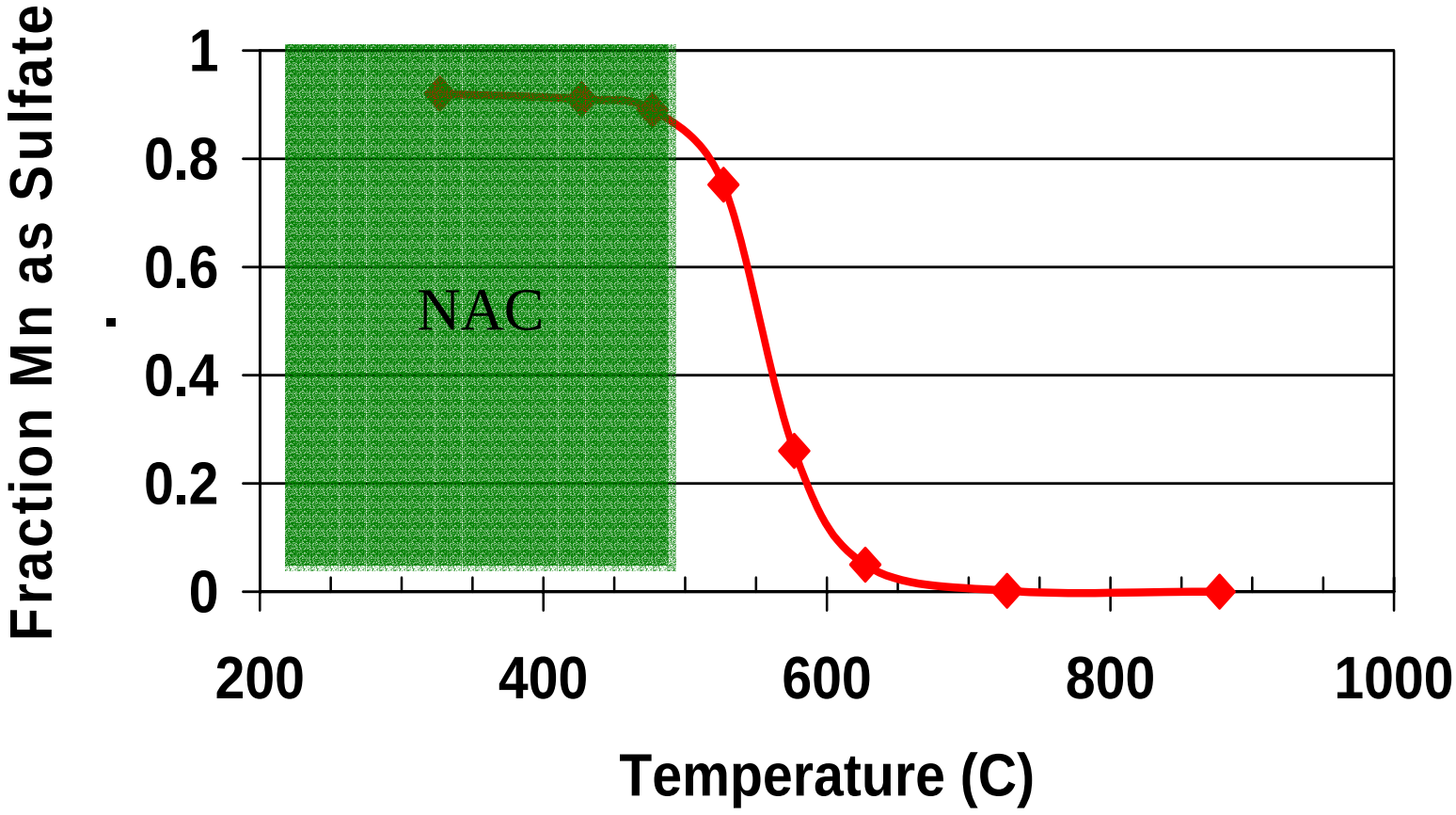
Update 8/22/03 Currently at 15,000+ miles with no change in slope

Diesel NOx Aftertreatment

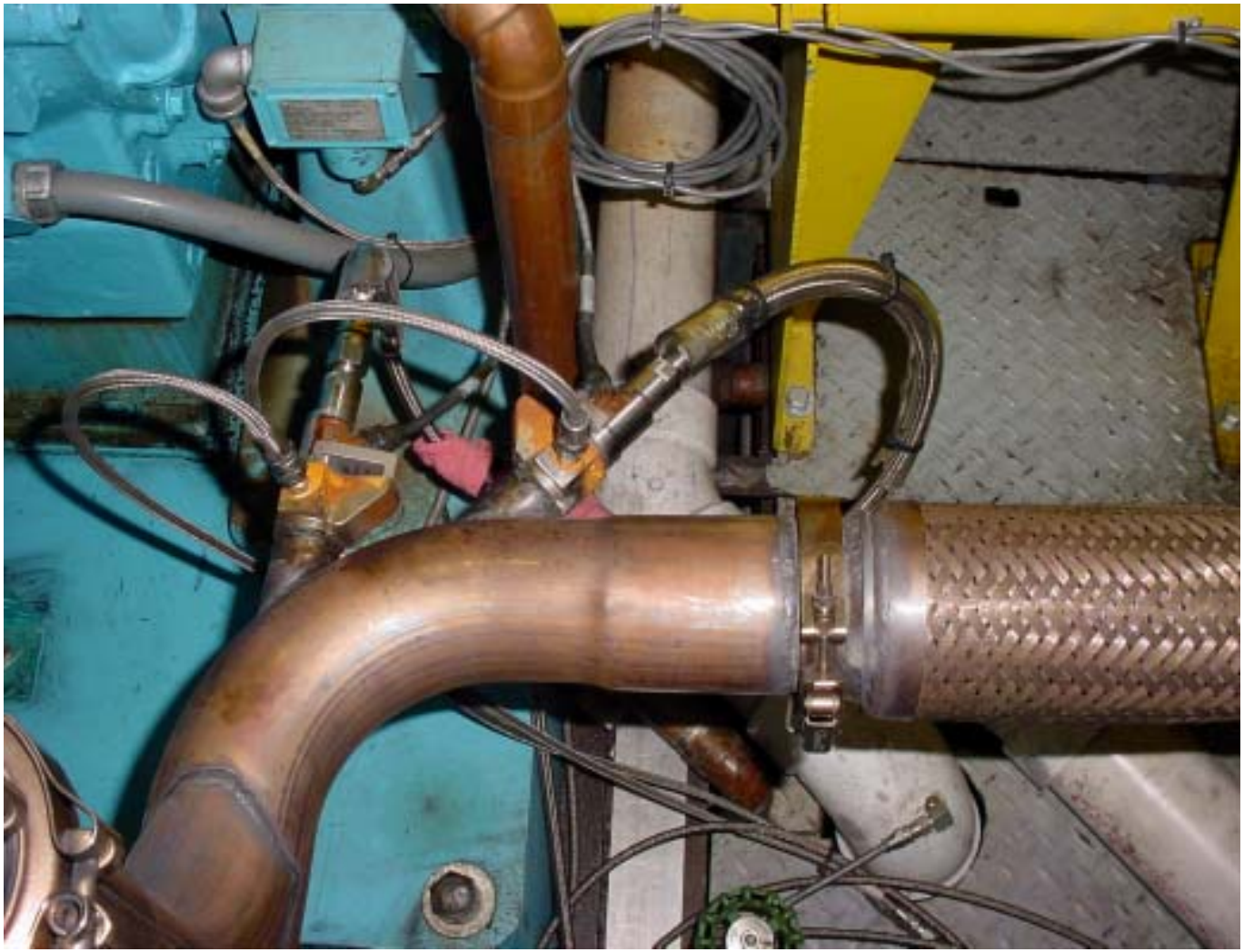
- Many current and proposed aftertreatment technologies are negatively affected by Phosphorous and Sulfur
- Sulfur will continue to exist in most diesel fuels at some level even after 2007
- P & S chemistry will continue to be used in crankcase lubricating oil to prevent wear and oxidation possibly at reduced levels
- One solution involves scavenging P & S with additives before interaction with aftertreatment

Mechanism For Sulfur Scavenging

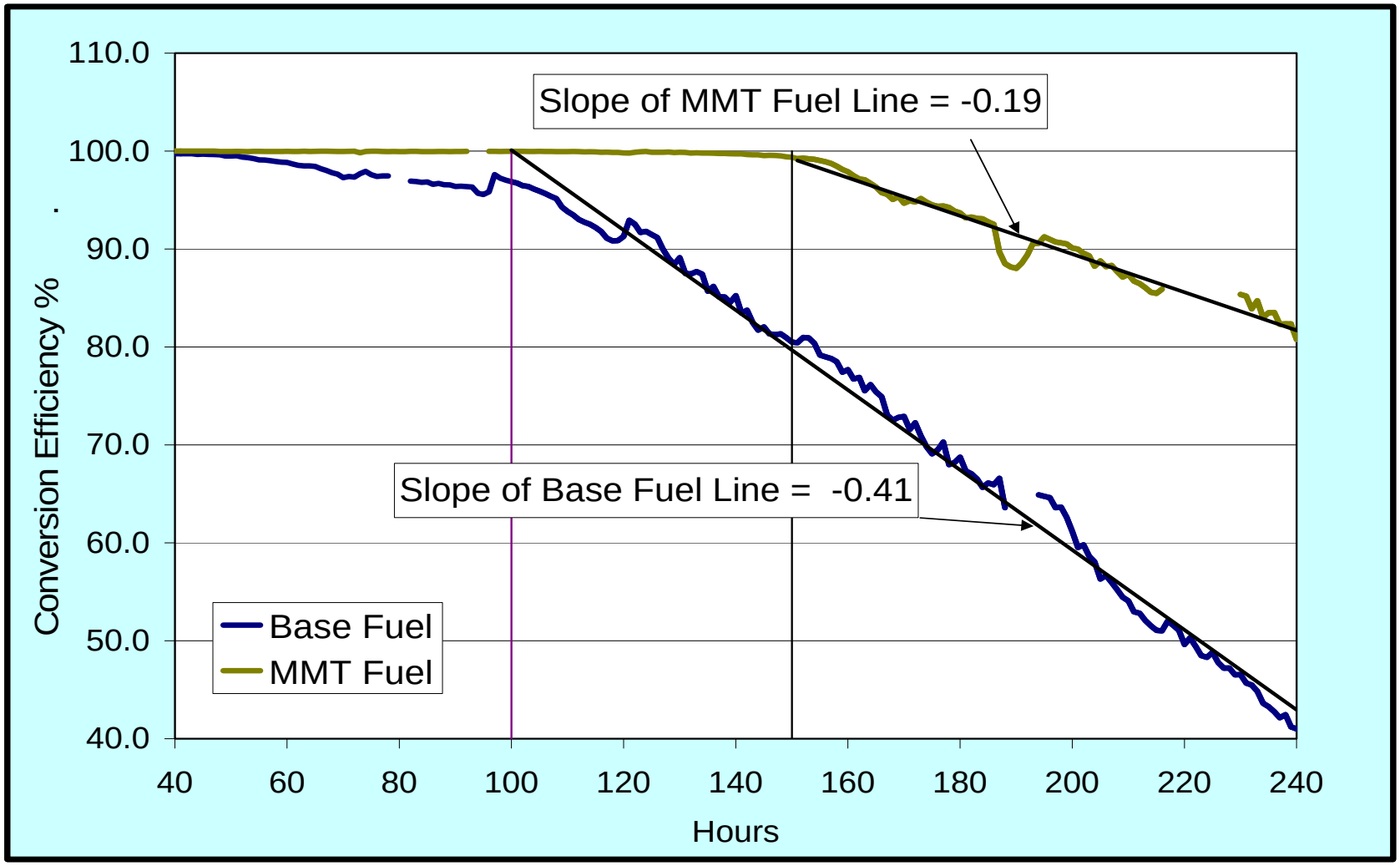
Manganese from combustion of MMT interacts with sulfur species in the exhaust to form Mn sulfate which is stable below 500°C



Supplemental Fuel System for NOx Regens



NAC Conversion Efficiency vs Time



Fuel Borne Catalyst Summary

Use of MMT in Diesel Fuel Improves Aftertreatment Performance

Phosphorous and Sulfur scavenging have been demonstrated in multiple diesel engines

Aftertreatment protection from P & S helps to preserve catalyst conversion efficiency

- **Higher lifetime catalyst efficiency will allow optimization of emission control systems**

MMT – Diesel Particulate Filters

MMT decreases the rate of soot accumulating in a DPF.

There is also a significant reduction in soot oxidation temperature leading to earlier and more complete regeneration.

- **Resulting lower average exhaust back pressure improves fuel economy**
- **Can reduce the need for heat addition to regenerate DPFs resulting in reduced fuel consumption penalty**

For more details on the joint Cummins/Ethyl DPF research look for SAE 2003-01-3145 at the Fall Powertrain and Fluids Conference

MMT in Diesel

Ethyl R&D continues to study fuel borne catalysts in current and advanced technology diesel engines

- Additional benefits of the fuel additive MMT in diesel have been discovered in bench tests and are being confirmed in engine tests
- **Not all fuel borne catalysts are the same!**