Ultrafine Control in Natural Gas Engines

Ultrafine Particle Conference

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May 2, 2006

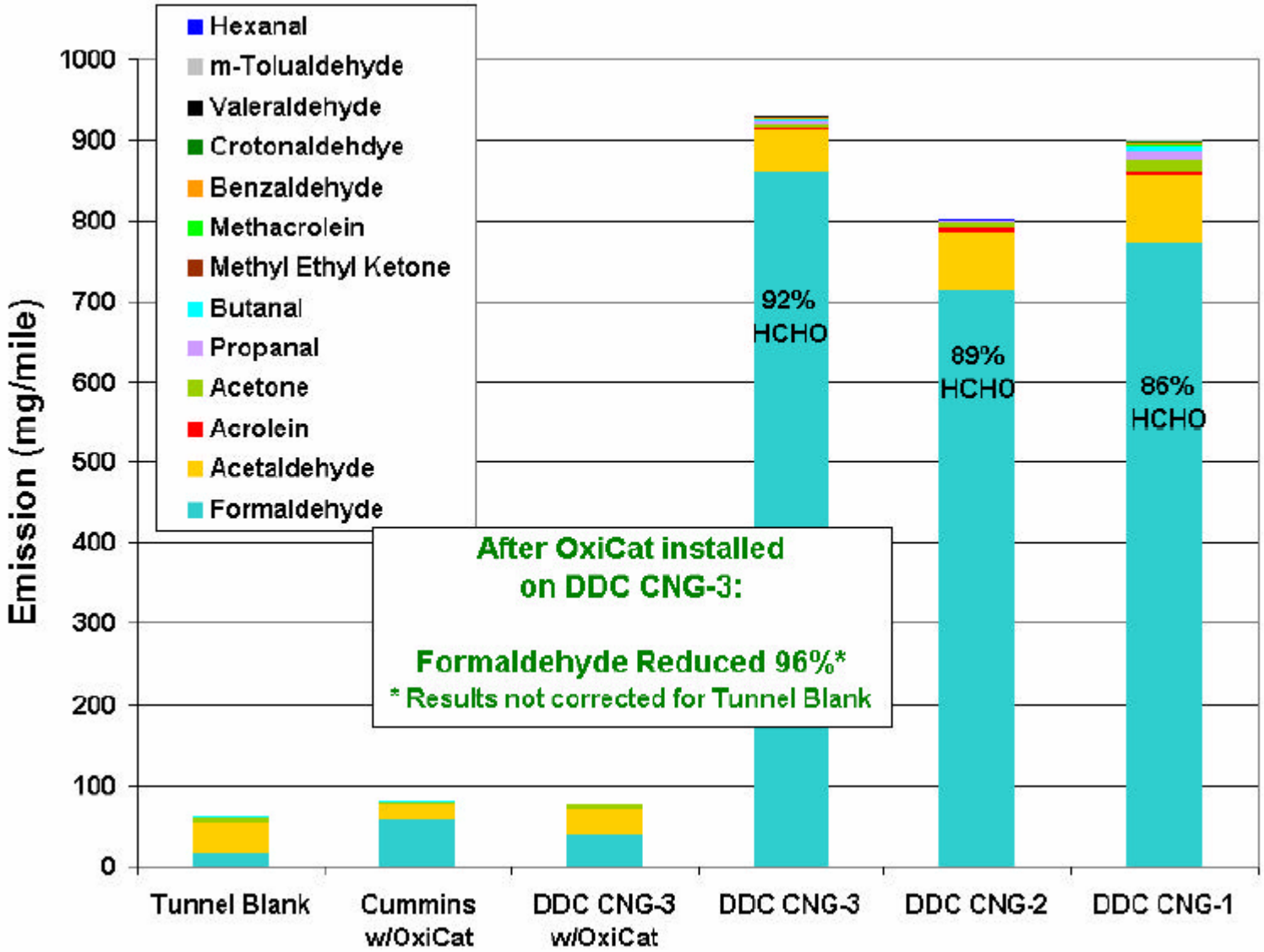
Natural Gas

- Premium fuel
- Engines deliver superior emissions
- Some things fuel can’t address
  - PM composition
  - Ultrafines

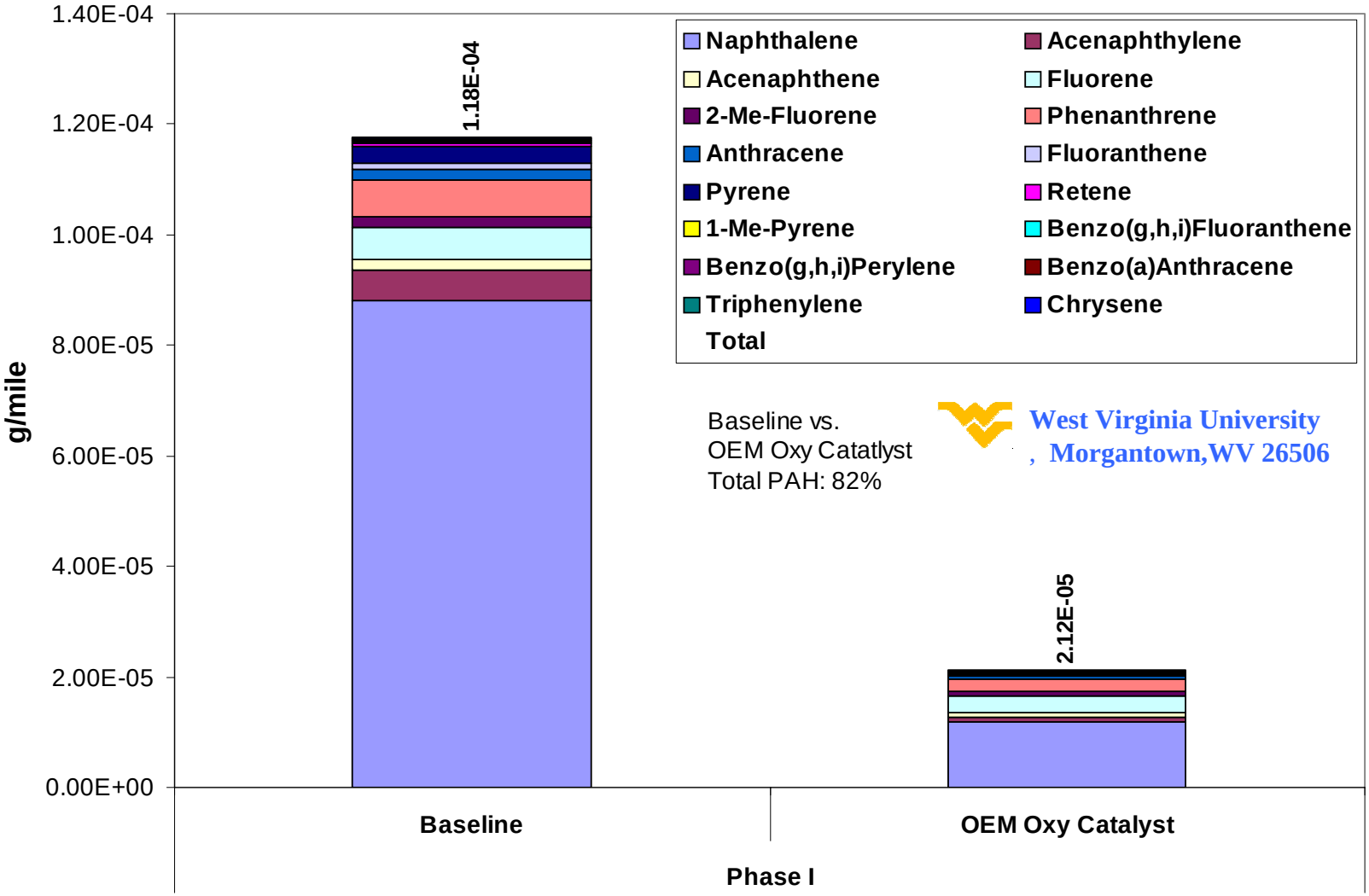
CARB Transit Bus Study

- Evaluate diesel and natural gas emissions
  - Diesel w/ and w/o DPF
  - Natural gas w/ and w/o Oxidation Catalyst

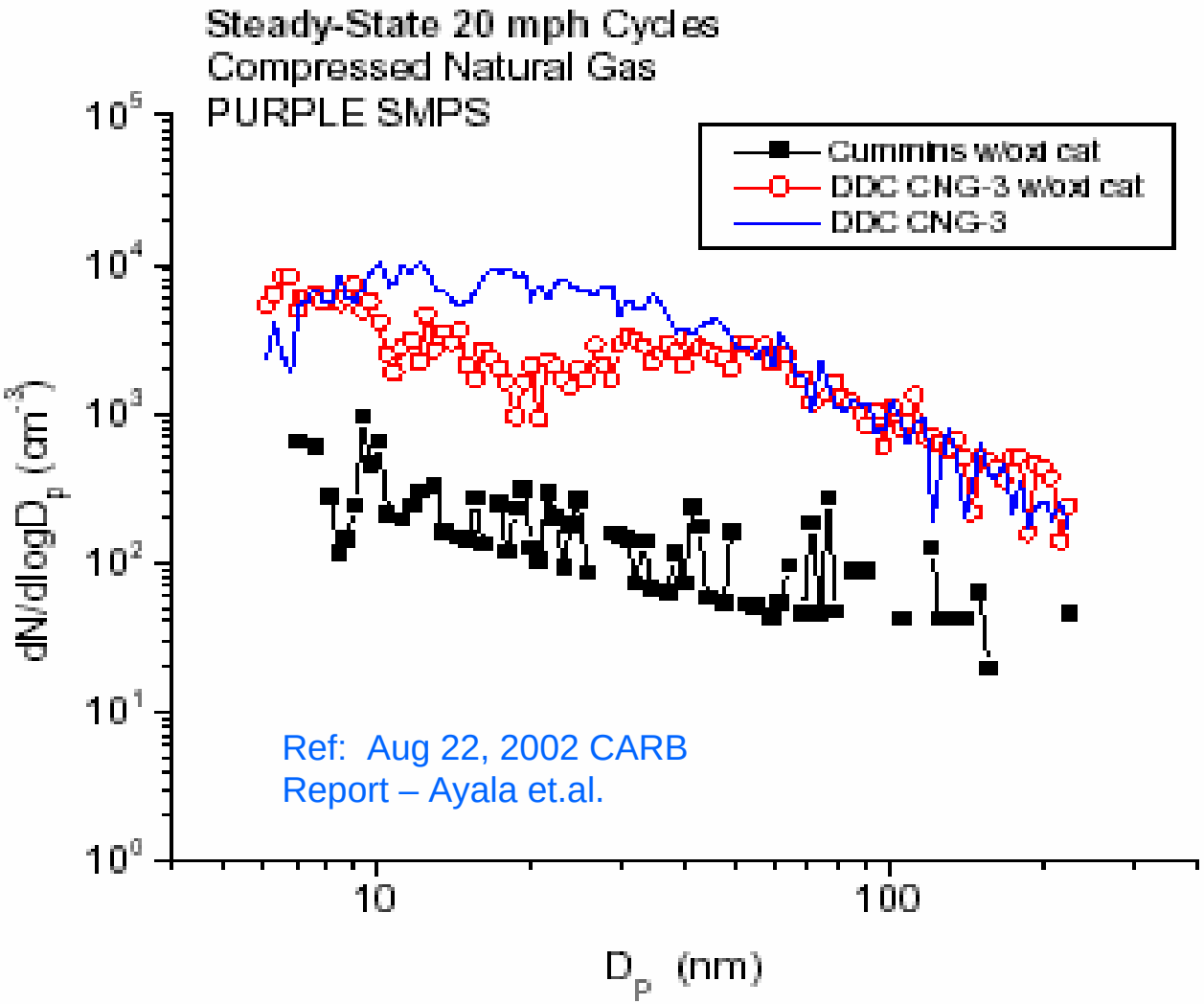
Impact of Oxidation Catalyst on Carbonyls



PAH Emissions

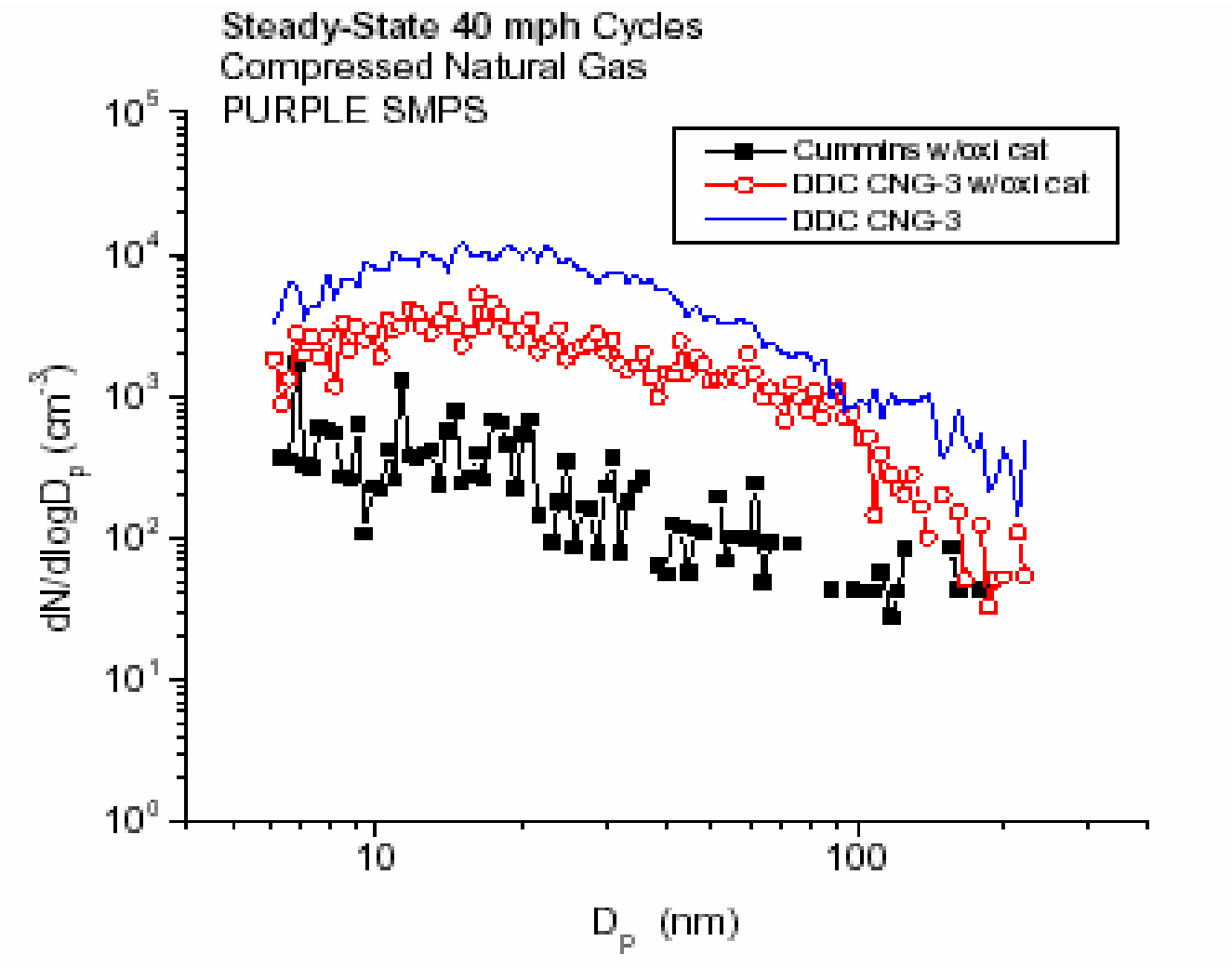


Impact of Oxidation Catalyst on Ultrafines

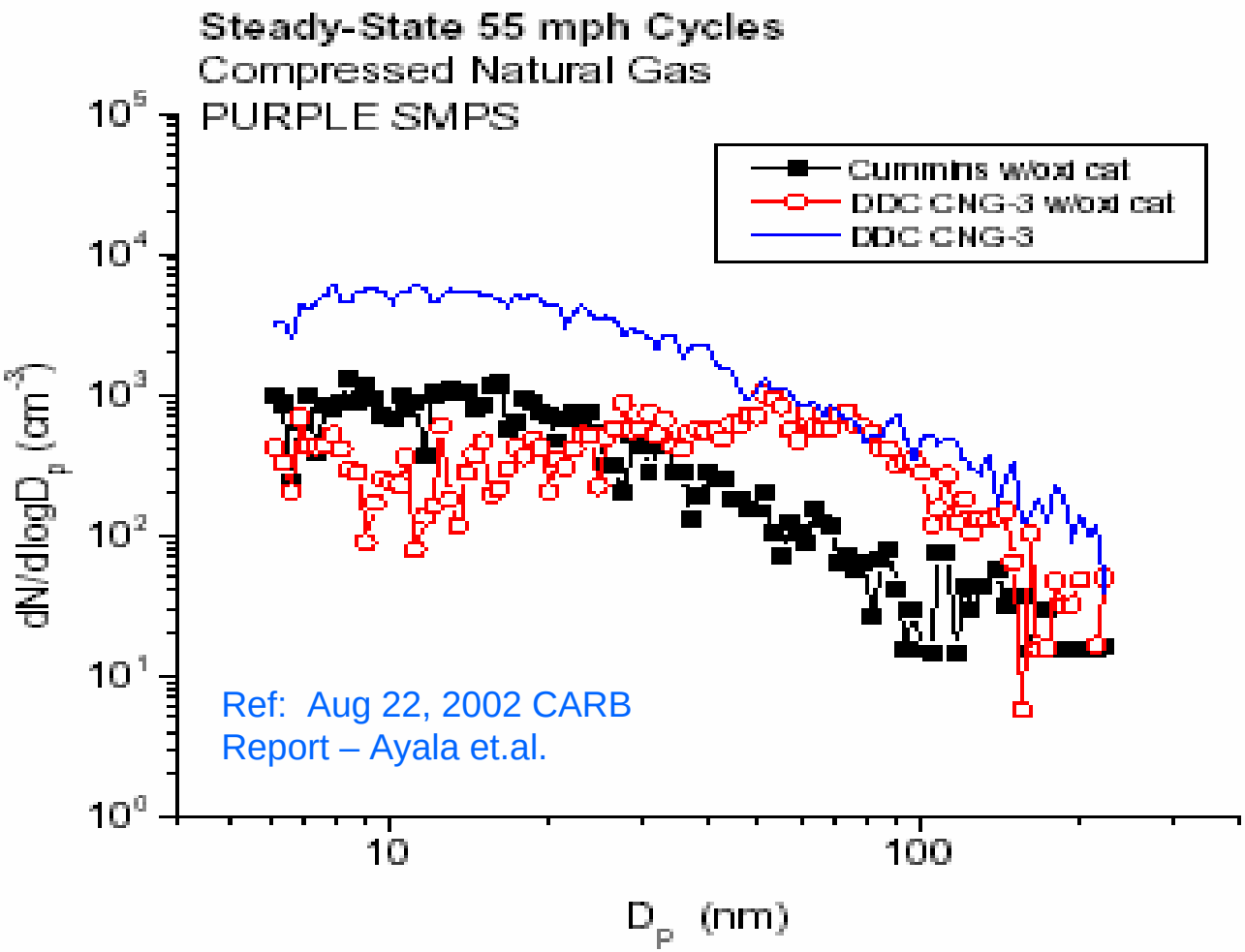


Ref: Aug 22, 2002 CARB Report – Ayala et.al.

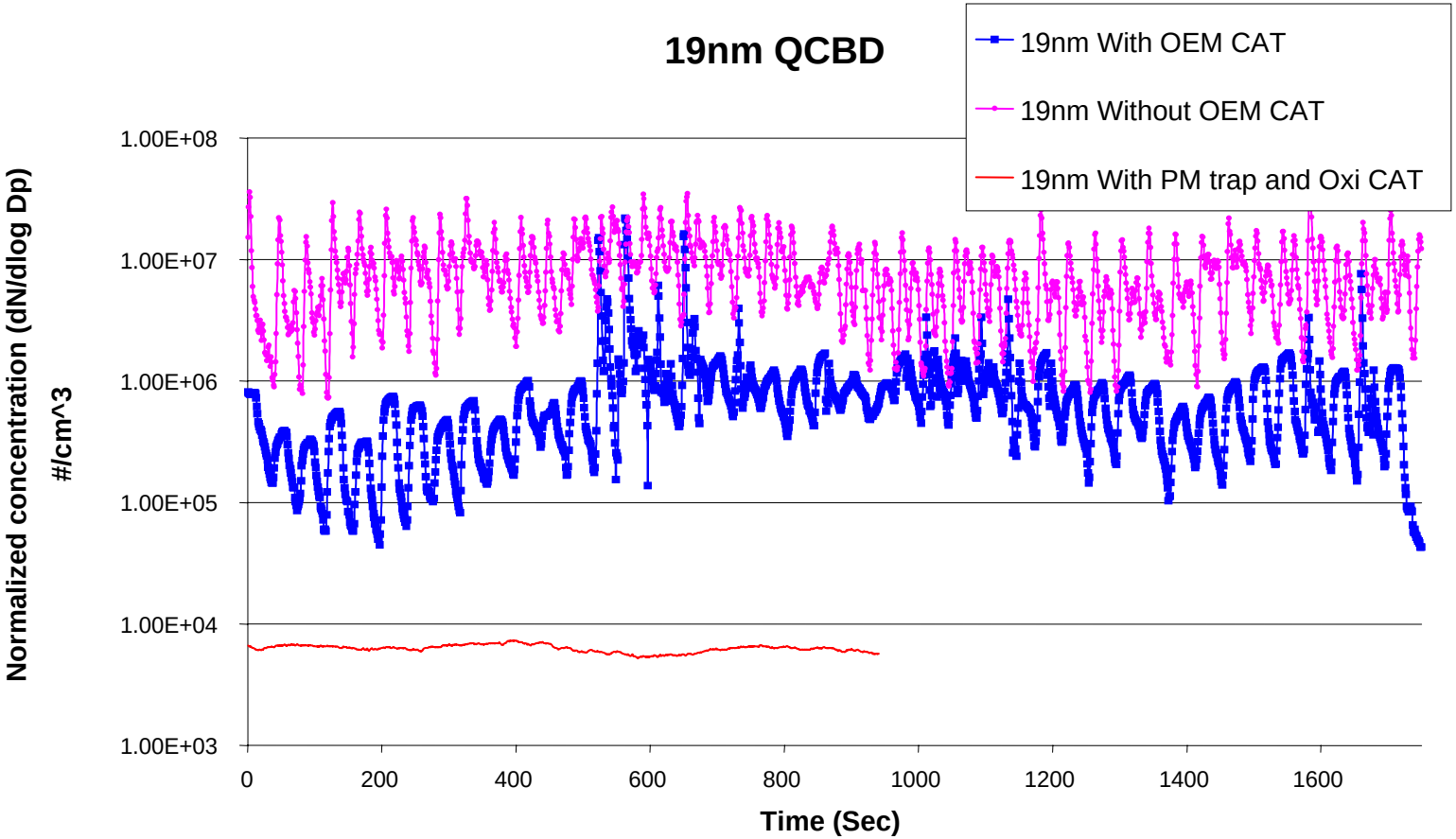
Impact of Oxidation Catalyst on Ultrafines



Impact of Oxidation Catalyst on Ultrafines



Phase II: Concentration Trace of Different Size Particles With WVU-Lubrizol Exhaust Aftertreatment Device



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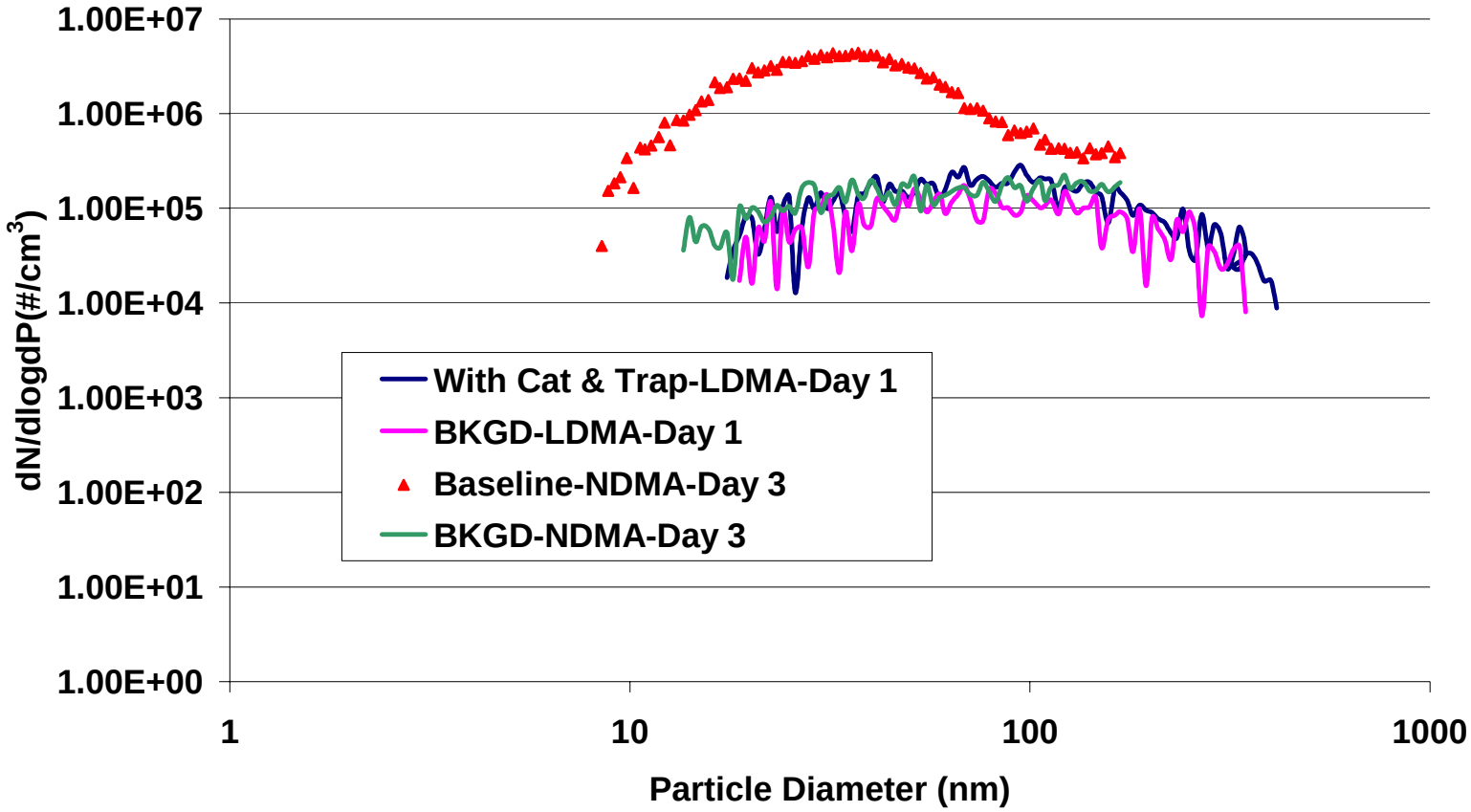
Phase III: Transit Bus Steady State Operation 35 mph PM Filter and Oxidation Catalyst



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Greater Control for Ultrafines

- Lubrication oil is certainly an issue
- Designer catalysts
- Synthetic oils
- Ring design