

Southwest Research Institute ®

Engine Lubricants Research Department

**Update on SwRI's IR&D Program To Study
Engine Oil Formulation Effects on Catalyst
Poisoning in an Engine Dynamometer Test**

**Presented to the
GF-5 Emissions System Compatibility Improvement Team
by
Scott Ellis**

24 April 2007



Recap of IR&D Project

- **Test engine – 2002 Chevrolet Malibu 3.1L V6**
- **240-hour test duration with 10 oil changes**
- **Test catalyst – 900 c.p.i., Pd/Rh washcoat, 0.6 L vol.**
- **Catalyst conversion efficiency measured in-situ before and after test**
- **0.1 wt. % Phos, non-detergent oil results very similar to those presented to ESCIT by Afton in August 2006**



Implemented Afton's Test Operating Conditions For Catalyst Aging

- **2000 rpm**
- **65.5 kPa MAP**
- **Externally heated oil sump to 150 °C**
- **Catalyst inlet temp ~530 °C**
- **Target PCV rate ~113 L/min (found this to be unnecessary)**

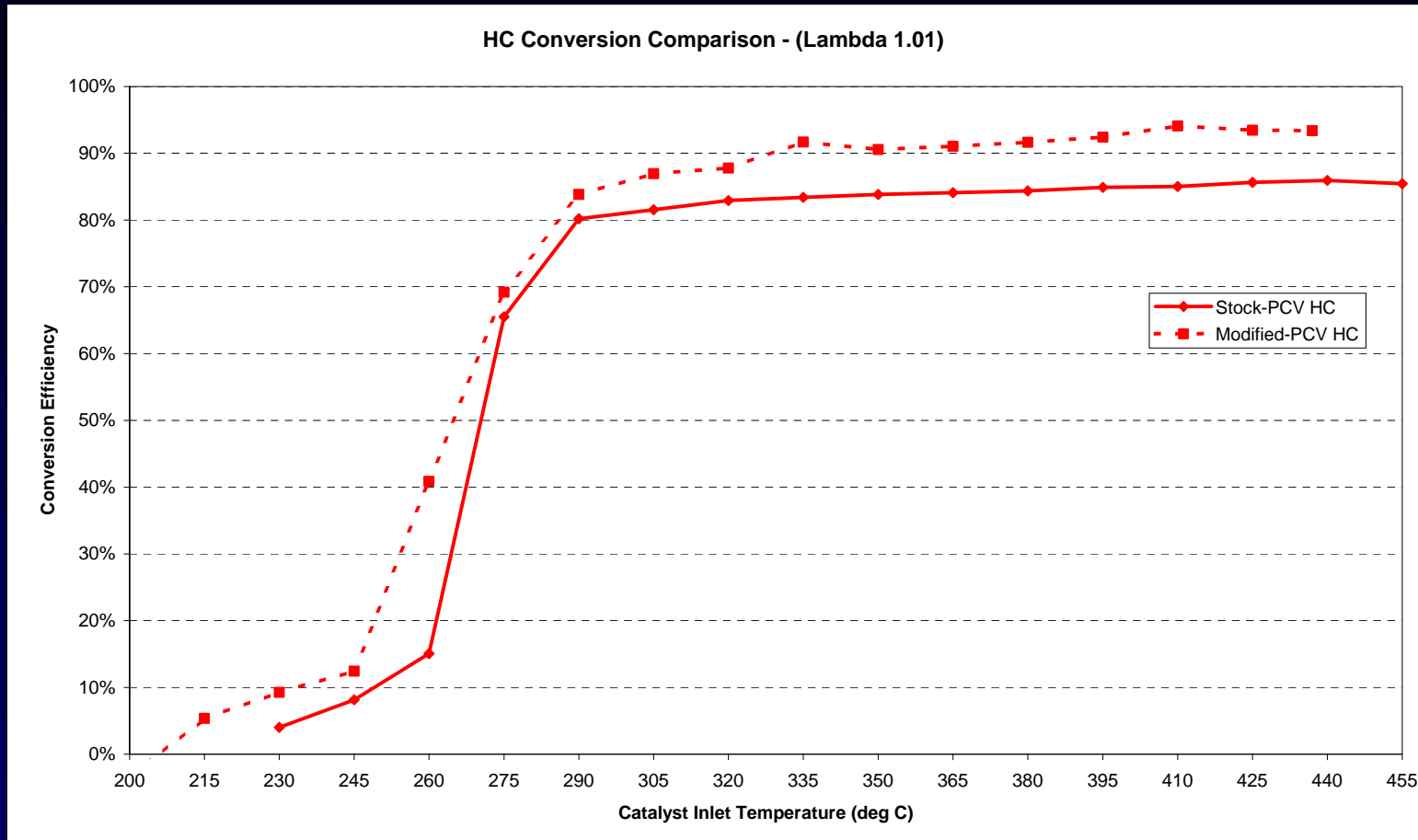


Revised Test Operating Conditions For Catalyst Aging

- GM not supportive of modified PCV system
- Reverted back to stock PCV configuration
- Re-ran 240-hr test on Oil 33 (0.1 Phos, non-detergent)
- Obtained nearly identical catalyst deactivation
- Oil consumption was more variable
- Future tests to be run with fixed orifice



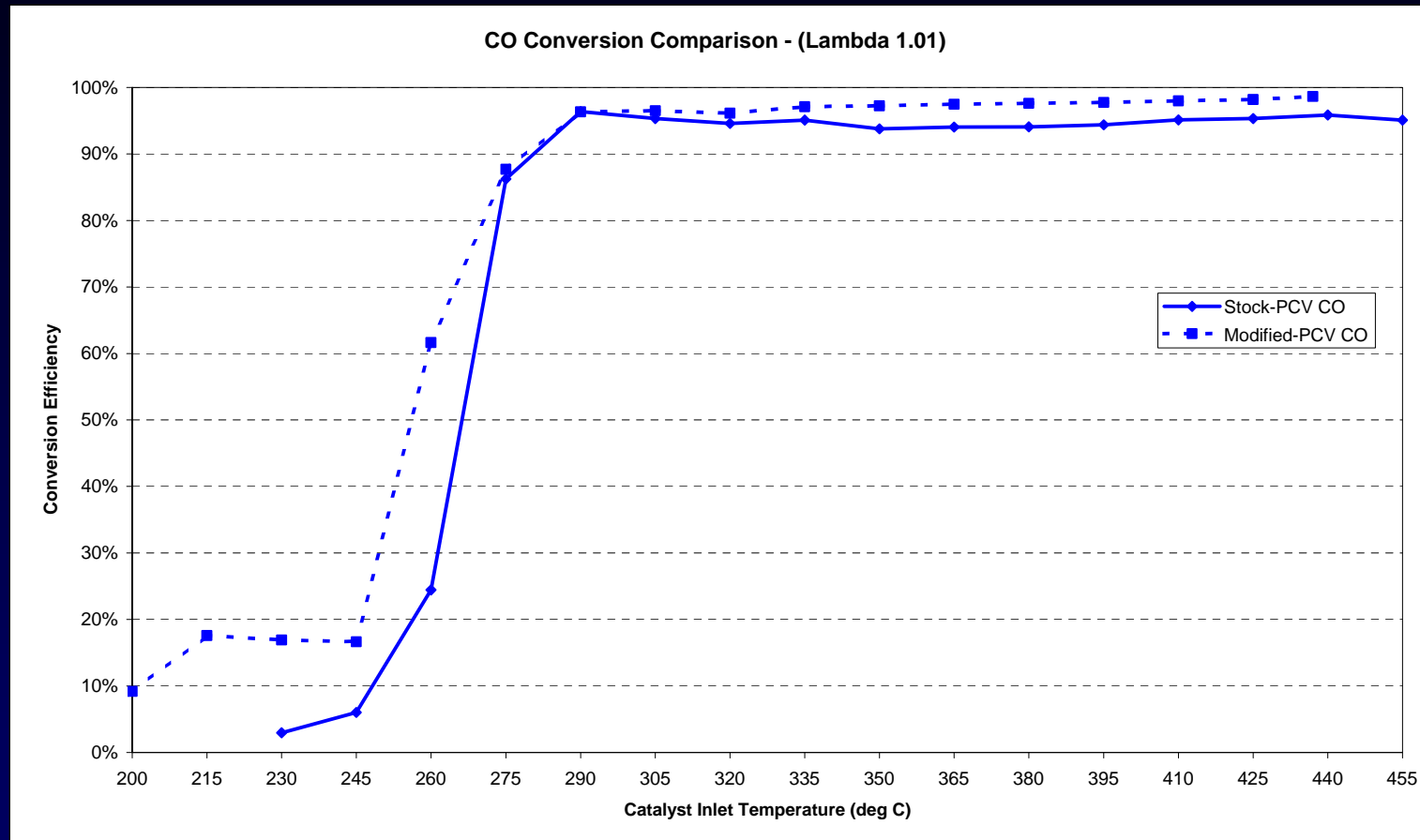
SOT Comparison of Modified vs. Stock PCV



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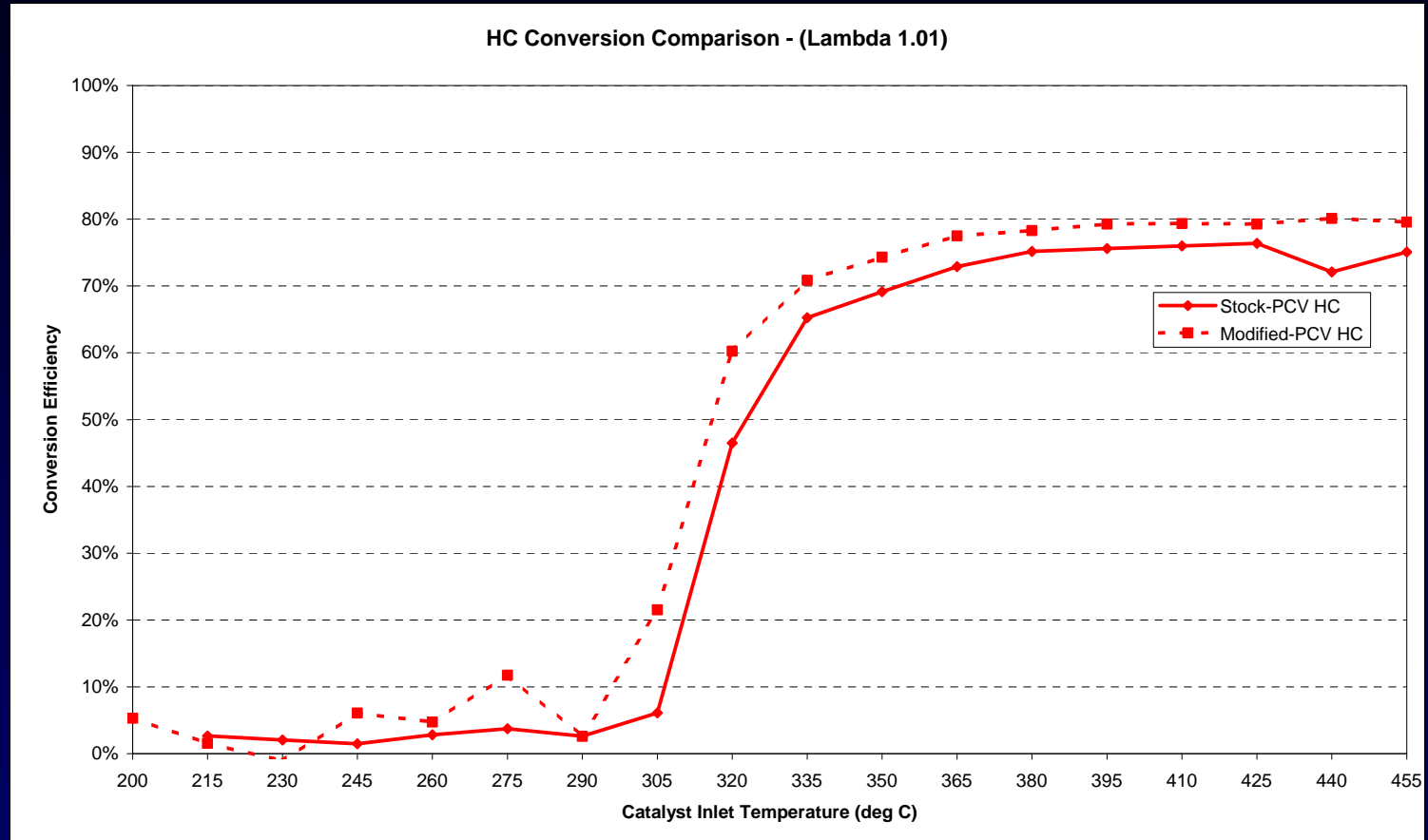
SOT Comparison of Modified vs. Stock PCV



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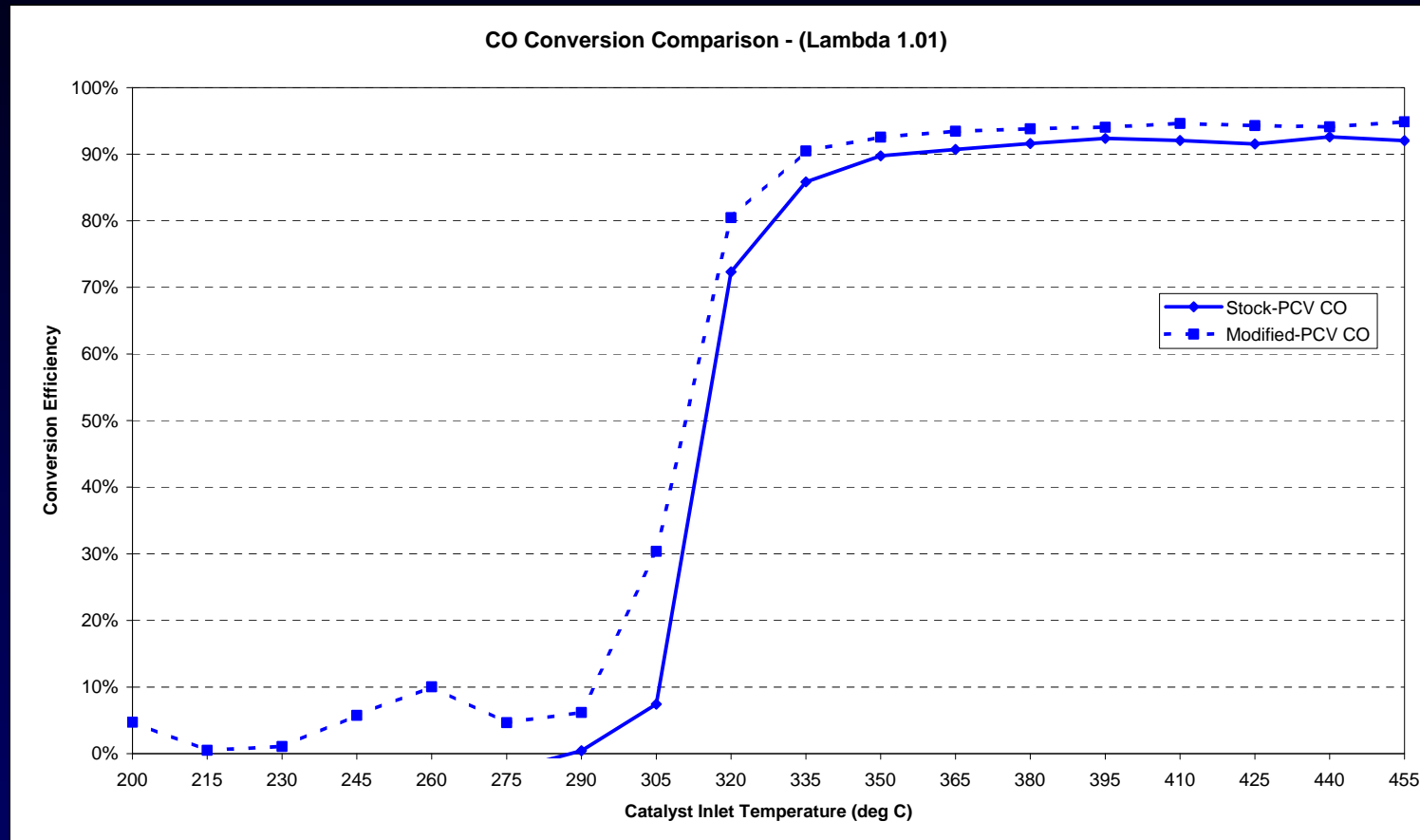
EOT Comparison of Modified vs. Stock PCV



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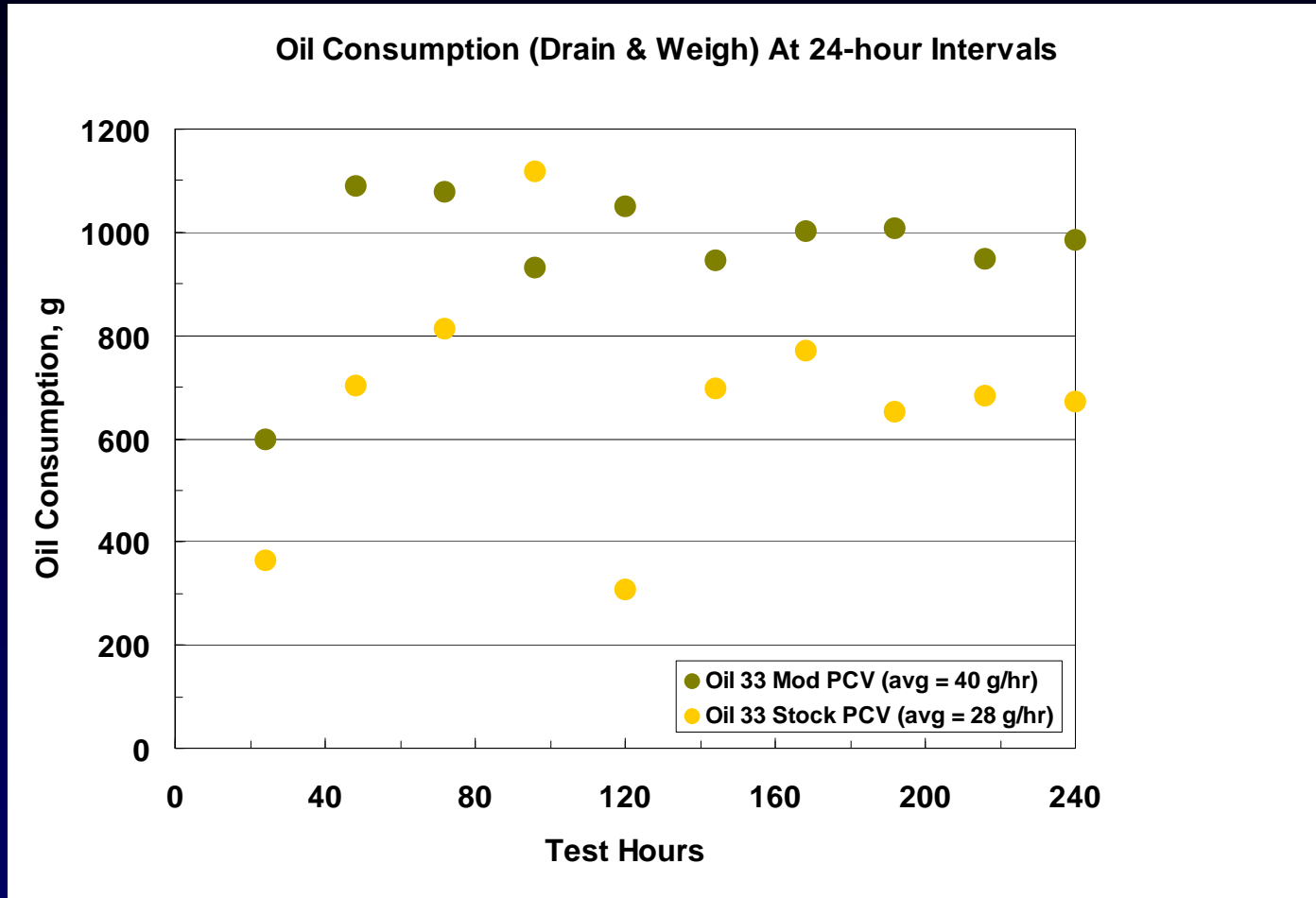
EOT Comparison of Modified vs. Stock PCV



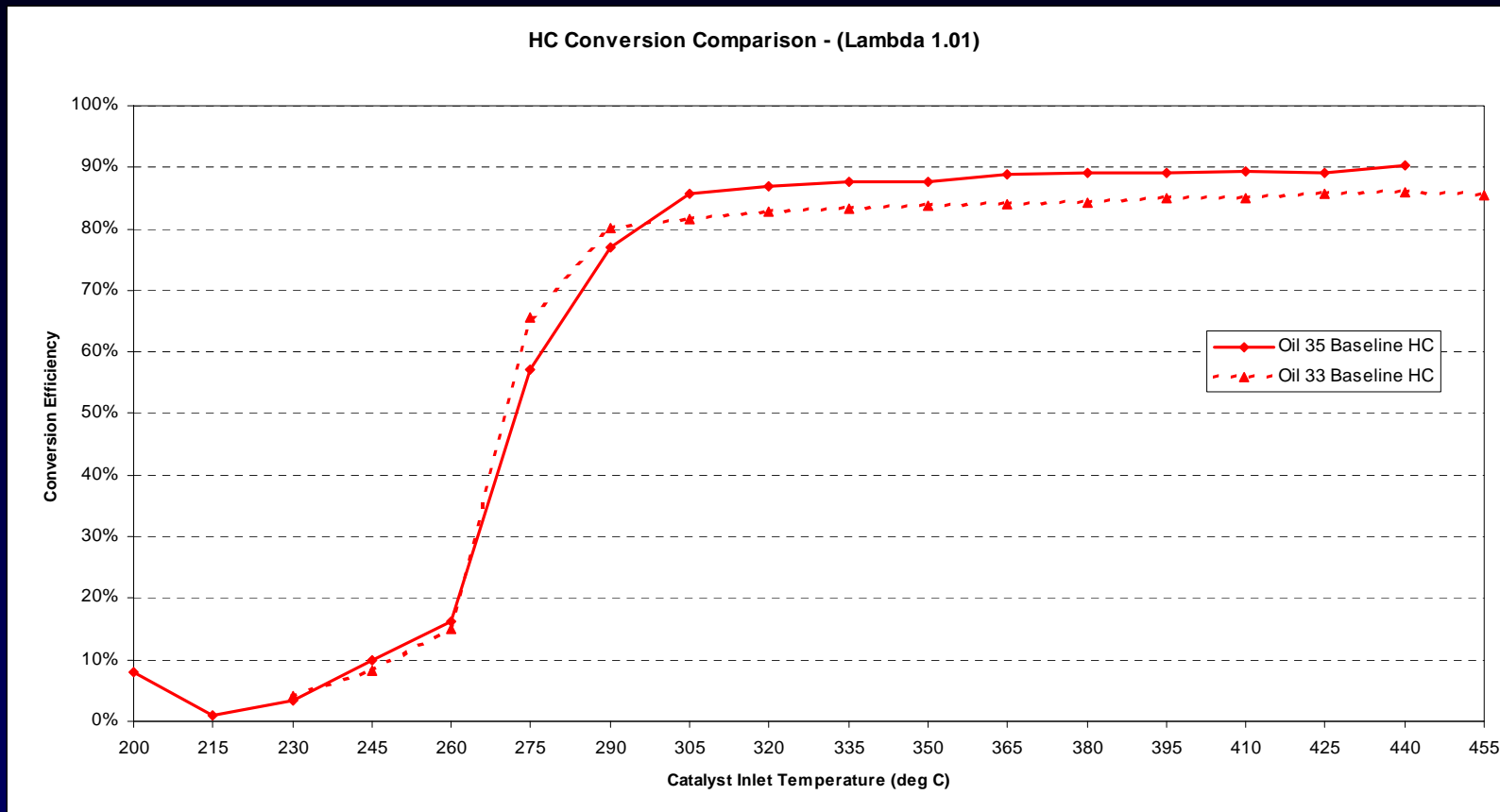
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Oil Consumption Measurements



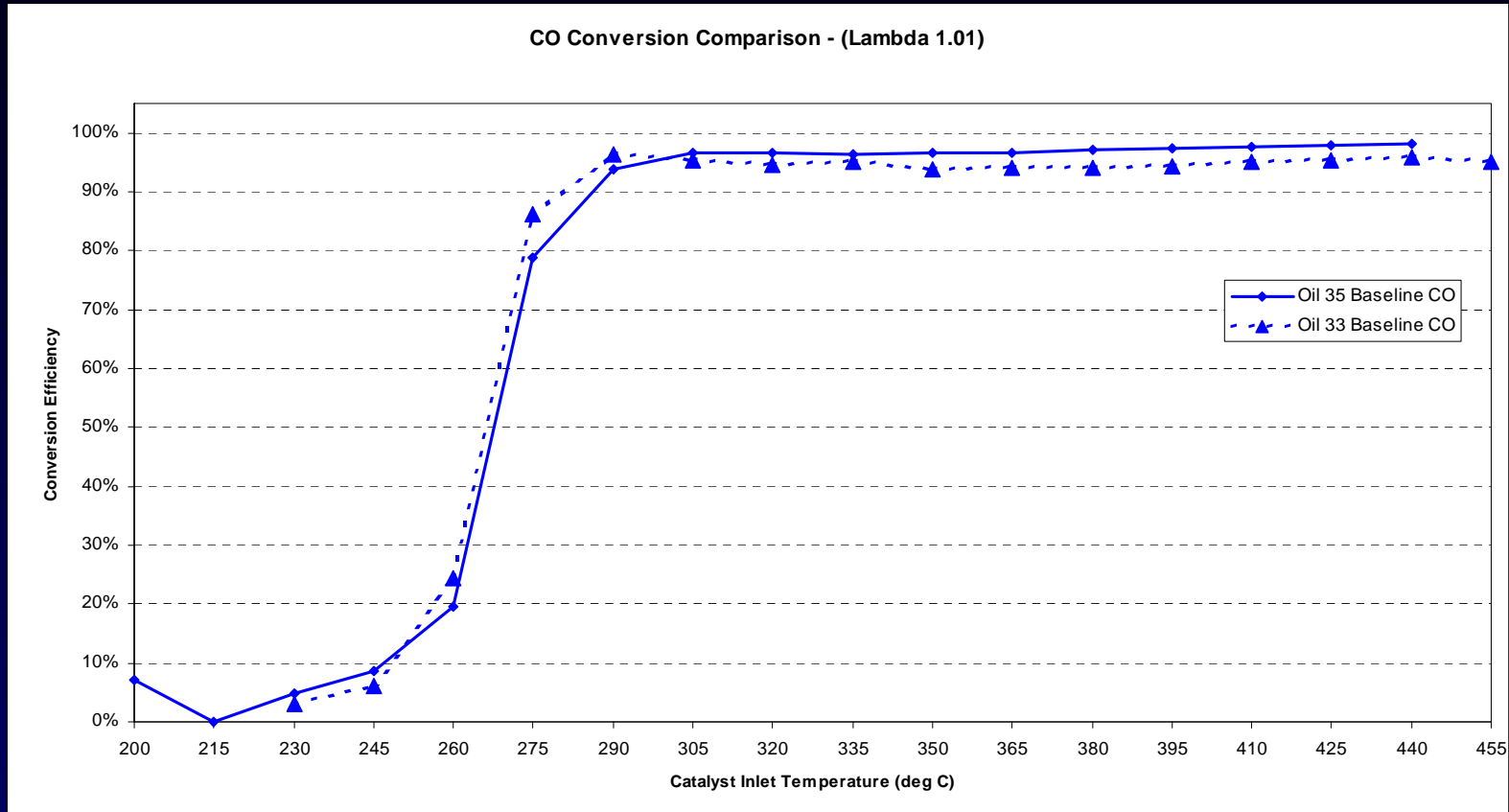
SOT Comparison of Oil 33 vs. Oil 35



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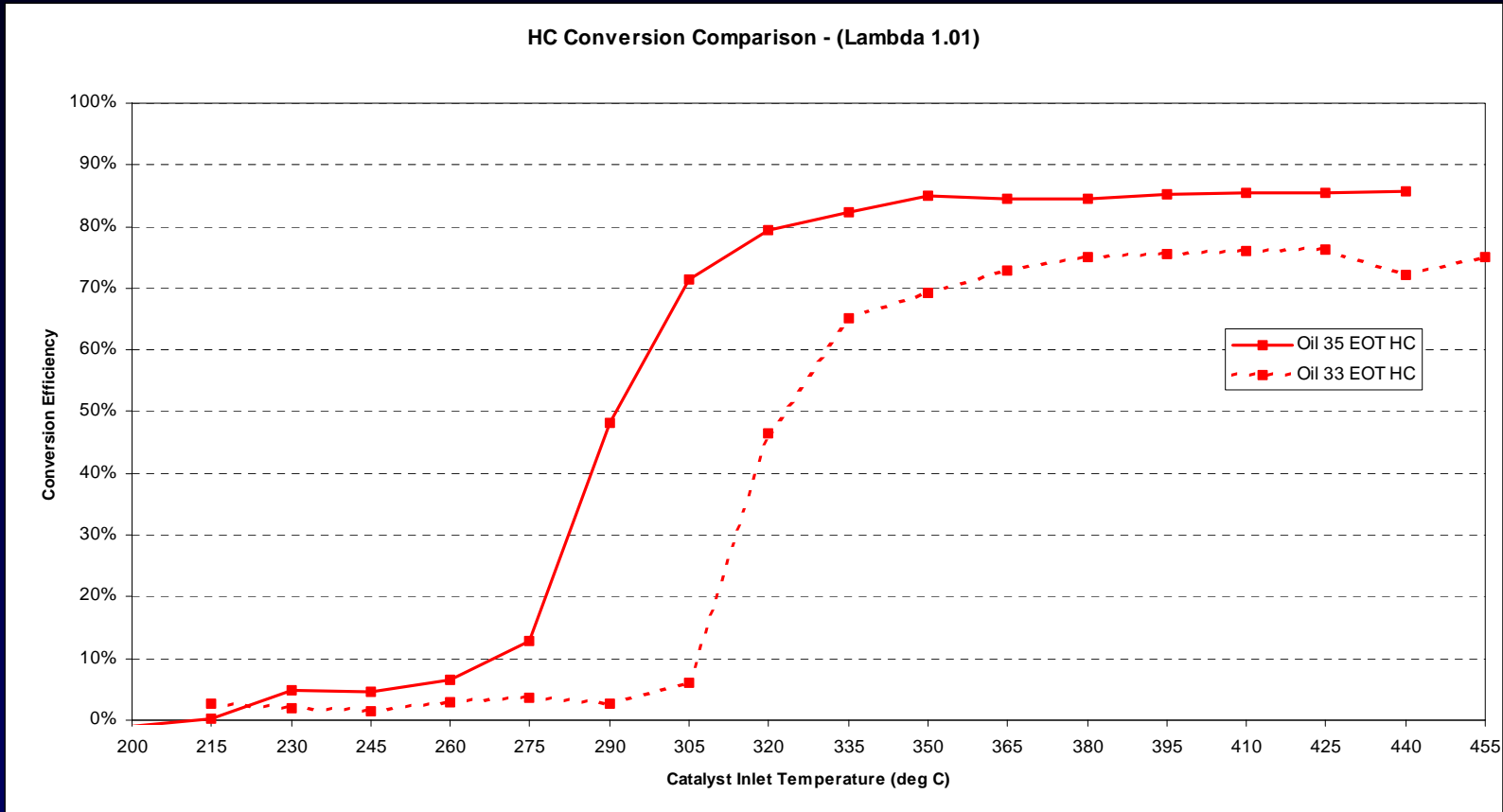
SOT Comparison of Oil 33 vs. Oil 35



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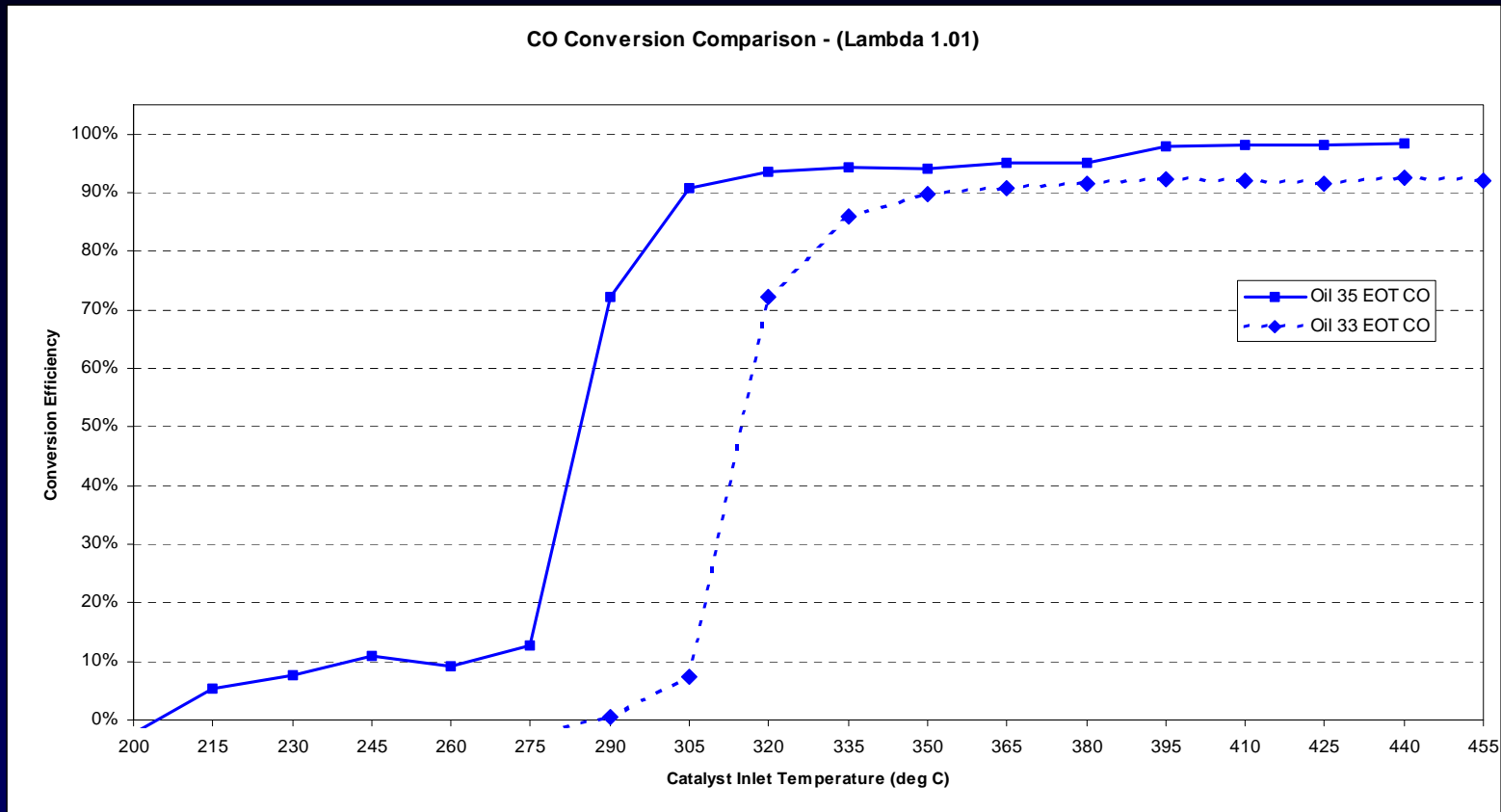
EOT Comparison of Oil 33 vs. Oil 35



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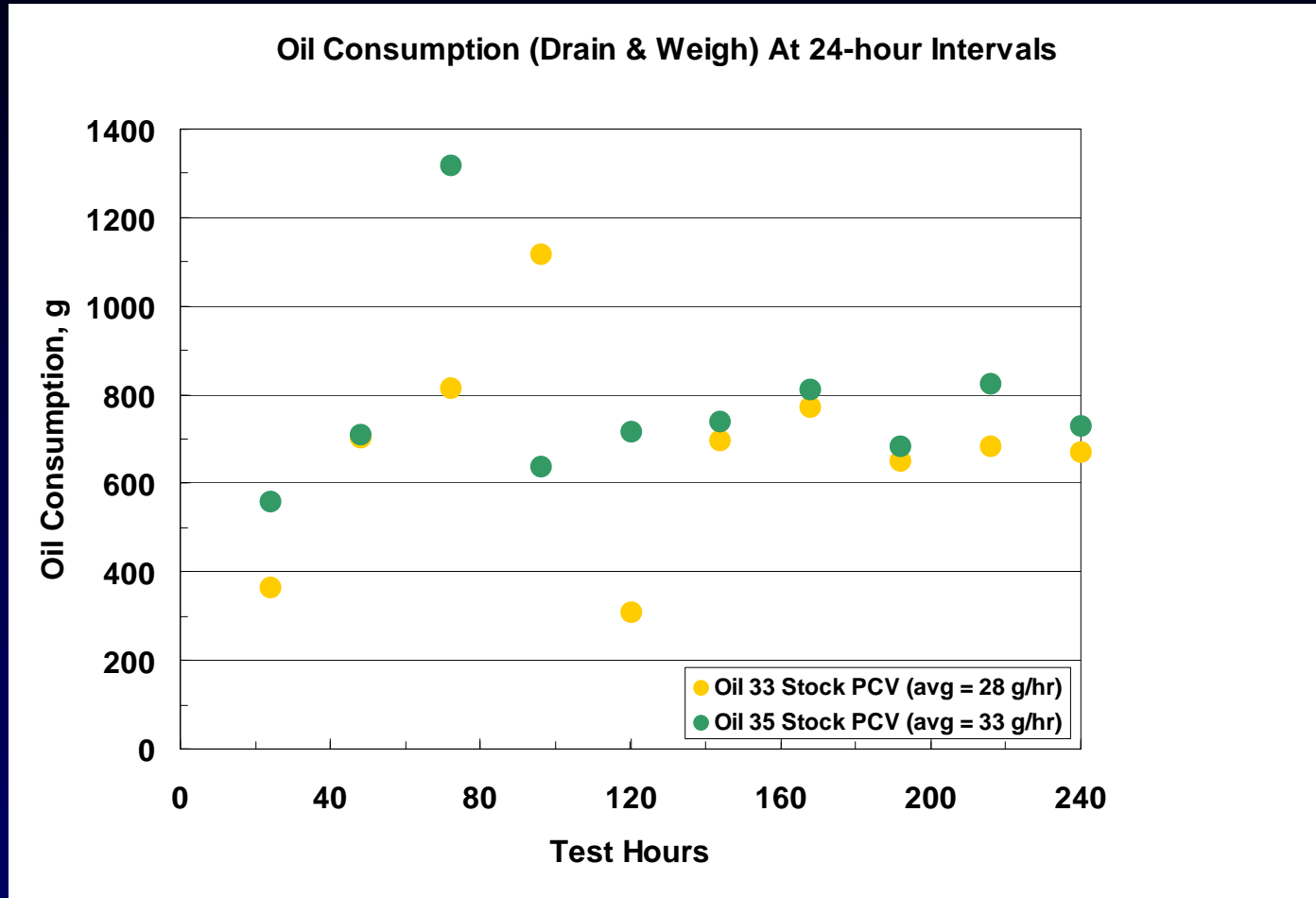
EOT Comparison of Oil 33 vs. Oil 35



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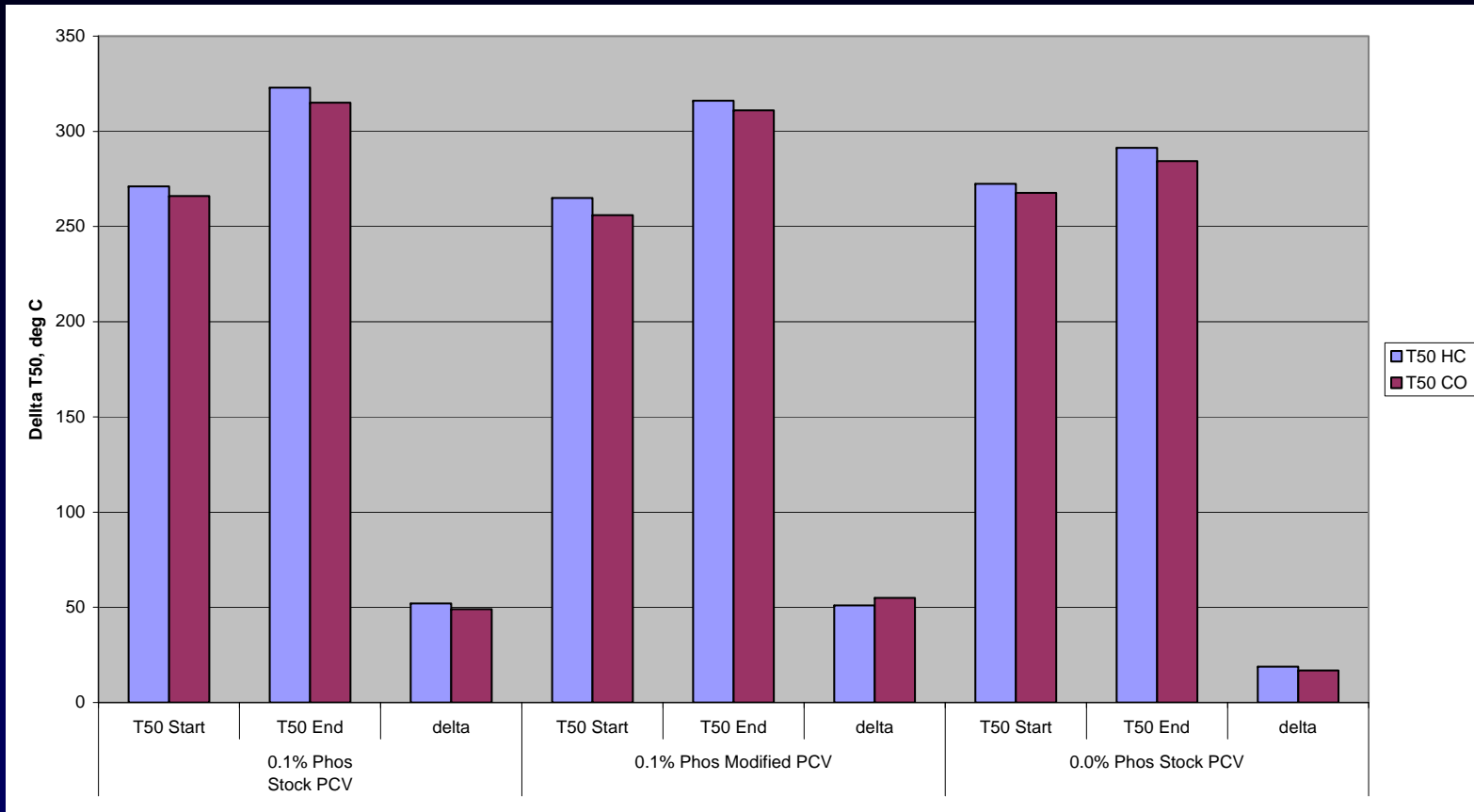
Oil Consumption Measurements



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Summary Data



Future Plans

- **Continue Test Matrix**
 - 1. Oil 33 (0.1 Phosphorus, no detergent)**
 - 2. Oil 35 (no Phosphorus, discrimination)**
 - 3. Modern formulation with conventional ZDP**
 - 4. Modern formulation with 'low impact' ZDP**
 - 5. Oil 33 (repeat-check)**

