THE IMPACT OF LUBRICANT FORMULATION ON EMISSIONS FROM A MEDIUM-DUTY DIESEL ENGINE

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Increasingly stringent engine emission standards are driving the need for advanced technologies that control nitrogen oxides (NO_x) and particulate matter (PM). To enable the efficient and durable application of these new technologies, a growing body of evidence suggests that diesel fuel quality improvements, specifically reductions in fuel sulfur content, are necessary. Recognizing that this may not be enough, additional research is underway to further examine if new lubricants will also be required in catalyst-equipped engines.

This presentation summarizes the results of the first in a multi-phase research agenda to quantify the effects of lubricant composition on the performance and durability of advanced diesel emission control systems. This first phase examines engine-out (i.e., catalyst-in) emissions from a 1999 International T444E (7.3L, V8) base engine that has been equipped with exhaust gas recirculation (EGR) and closed crankcase ventilation (CCV) systems.

Twelve additive technologies spanning a range of key properties were blended in up to four separate basestocks. Engine emissions, using each of the finished lubricants, were evaluated over a modal steady-state operating cycle. In addition to measuring gaseous emissions, PM was collected in three separate sample trains and analyzed for mass, soluble organic fraction, sulfates, nitrates, metal content, and polycyclic aromatic hydrocarbons.

These results form the basis of follow-on work that is studying how these lubricant-derived emission components impact diesel emission control system performance. This work is being conducted within the U.S. Department of Energy's Advanced Petroleum Based Fuels – Diesel Emission Control Activity, a Government/Industry collaborative research program to study advanced fuel- efficient systems for diesel emission control.