THE IMPACT OF OIL CONSUMPTION MECHANISMS ON DIESEL EXHAUST PARTICLE-SIZE DISTRIBUTIONS AND DETAILED EXHAUST CHEMICAL COMPOSITION

John Stetter, Nathan Forster, Jaal Ghandhi and David Foster

University of Wisconsin – Madison

ABSTRACT

Detailed exhaust emission data have been taken from a Cummins N-14 single-cylinder research engine in which the oil consumption was varied by different engine modifications. Low-sulfur fuel was used, and oil consumption was varied by modifying the intake valve stem seals, the exhaust valve stem seals, the oil control ring, and combinations of these modi-fications. Detailed measurements of exhaust gas particle-size distributions and chemical composition were made for the various oil consumption configurations for a range of engine loads and speeds.

The data indicate that the particle-size distribution is impacted by oil consumption of the engine. Furthermore, the nature of the change in particle-size distribution depends on the mech-anism of the oil consumption. For example, the diameter of the maximum particle concentration shifts from being smaller than, to being larger than, the base engine case for different oil con-sumption modes and different operating con-ditions.

The particulate mass was measured with TEOM and traditional gravimetric filter me-thods. Filter data for elemental carbon/organic carbon, sulfates, and trace metals have been taken and are being analyzed. The trace metals in the particulate mass serve as the basis for assessing oil consumption at the dif-ferent operating conditions. The results of these analyses will be presented.