UNREGULATED (AND UNWANTED) EMISSIONS FROM DIESEL ENGINE EMISSIONS CONTROL DEVICES

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There is a widespread consensus that catalytic emissions control will be required in order for diesel engines and light-duty diesel vehicles to meet the 2007 and 2009 EPA source emissions regulations for particulate matter (PM) and NO_x. Two of the leading candidates for PM emissions control are the continuously regenerable diesel particulate filter (CR-DPF) and the catalyzed diesel particulate filter (CDPF). Earlier work in the Diesel Emissions Control – Sulfur Effects (DECSE) program showed that fuel sulfur can actually cause both of these devices to increase PM mass emissions, an increase almost wholly caused by an increase in sulfate emissions. While the DECSE program considered fuel sulfur effects on regulated emissions, ORNL evaluated fuel sulfur effects on the CR-DPF and the CDPF for their ability to remove toxics from the exhaust and their effect on PM size distribution. Results showing hydrocarbon species destroyed and formed in DPFs as well as the origin of nanoparticles will be presented.

Urea-selective catalytic reduction (SCR) and NO_x adsorber catalysts are emerging as a leading contender for NO_x control in diesel engines. Urea-SCR offers the benefit of being less sensitive to sulfur than NO_x adsorber-type catalysts. An important topic to examine, however, is the possible formation of exhaust byproducts from the use of urea-SCR. Urea decomposition products include cyanuric acid, biuret, and melamine complexes. These compounds are difficult to measure analytically. Results of our methods development work and analyses of real samples from a DPF-urea SCR-equipped engine show the presence of these compounds due to the combination of hydrocarbons and trapped NO_2 in a chemically reducing environment. Results will be presented from the analysis of exhaust samples from both a light-duty diesel vehicle equipped with a DPF and NO_x adsorber as well as a medium-duty engine equipped with a NO_x adsorber.