Temperature and driving cycle significantly affect semivolatile organic compound emissions from diesel trucks

Michael Hays, Barbara George, Ingrid George, Richard Snow, James Faircloth, Thomas Long and Richard Baldauf*

United States Environmental Protection Agency, Office of Research and Development, RTP, NC 27711.

William Preston

CSS-Dynamac, 1910 Sedwick Road, Durham, NC 27713

*Corresponding Author: hays.michael@epa.gov

Abstract: The U.S. currently produces roughly 5 billion liters of biodiesel per year. Use of biodiesel is projected to increase based on its potential economic, energy, and environmental benefits. Despite these benefits, there is public health concern about the possible direct and indirect environmental and air quality impacts associated with biofuel use. National biofuel policy includes an anti-backsliding provision based on the risk of negative or adverse air quality impacts following implementation of the Renewable Fuel Standard (RFS). The present study examines the effects of fuel (an ultra-low sulfur diesel [ULSD] versus a 20% v/v soy-based biodiesel—80% v/v petroleum blend [B20]), temperature, load, vehicle, driving cycle, and regeneration technology on semivolatile organic compound (SVOC) emissions from diesel trucks. The study is performed using chassis dynamometer facilities that support low temperature operation (-7 °C versus 22 °C) and heavy loads up to 12,000 kg. Gas- and particle-phase SVOC emissions collected using traditional filter and polyurethane foam sampling media are analyzed using advanced gas chromatography-mass spectrometry methods. Carbon analysis is performed using a thermal-optical technique. Interestingly, replacing ultra-low sulfur diesel with B20 did not significantly influence SVOC emissions. However, both low temperature and vehicle cold-starts significantly increase SVOCs in the truck exhaust. Vehicle regeneration technology did influence emissions in real-time; although, regeneration effects went unresolved in bulk samples using chromatography techniques. Finally, our emission rates will be compared with national inventory data, which currently show that individual SVOC emissions from diesel trucks can vary over several orders of magnitude.