and load conditions. Under load, abundances of hopanes and steranes using ULSD and B20 were similar, and higher than those using Swedish diesel and B100, which suggests that Swedish diesel and B100 fuels yield less unburned oil. At idle, PM emissions using B20 and B100 were the highest among the four fuels, BC abundances were low, and BC, hopanes and steranes abundances followed the ranking: Swedish diesel > ULSD > B20 >B100. This study demonstrates the dependence of marker emissions on fuel type and engine conditions. This information can be used to estimate exposure associated with health risks, and is important for apportionment studies aimed at identifying the diesel-related component of ambient pollutants.

Keywords: Biomarkers, Contaminants - Particulate matter, Medium - Air

RP1-24

Effect of Fuel Composition on PAH and Nitro-PAH Emissions from a Medium-Duty Diesel Engine

S. Batterman[1], L. Huang[1], S. V. Bohac[2], J. CHIN[1], S. Chernyak[1]; [1]University of Michigan, Department of Environmental Health Sciences, Ann Arbor, MI, [2]University of Michigan, Department of Mechanical Engineering, Ann Arbor, MI

Abstract: Polycyclic aromatic hydrocarbons (PAHs) and their nitro-derivatives, nitro-PAHs (NPAHs), are air pollutants that arise from many sources, including diesel engine exhaust. Alternative fuels have the potential to reduce emissions, but little information exists regarding the effect of fuel composition on PAH and NPAH emissions. This study investigates PAH and NPAH emissions for three fuels: ultra-low sulfur diesel (ULSD); Swedish Environmental Class 1 low sulfur/low aromatic diesel; and biodiesel (B100, 99.9% soy methyl ester). Well controlled and monitored bench tests were conducted using a 6.4 L Ford Power Stroke diesel engine with a 2004 emission calibration under idle, low load and medium load conditions. Exhaust emissions were collected on filters and analyzed by GC-MS for PAHs and NPAHs. The PAH emission rate, as ng/s, was lowest under idle and increased with engine load for all test fuels. Fuel type strongly affected PAH emissions: emissions using B100 were 5 to 40 times lower than those using ULSD. The ranking of PAH emissions was generally ULSD > Swedish diesel > B100. The most abundant PAH was usually naphthalene, then pyrene, acenaphthylene and acenaphthene. NPAH emissions, as ng/s, were also lowest under idle and increased with engine load for ULSD and Swedish diesel, but for B100, NPAH emissions were highest when idling and lowest at low load. Under load, NPAH emissions were ranked as ULSD > Swedish diesel > B100, following the trend for PAHs. While idling, however, the ranking was Swedish diesel > ULSD > B100. The most abundant nitro-PAHs were 6-nitrochrysene, 2-nitrofluorene, and 2-nitrobiphenol. PAH and NPAH compositions did not change significantly between different fuels and conditions. This study shows the dependence of diesel emissions on fuel composition, which has considerably changed in recent years. The reported emission rates and profiles can be used to estimate exposure, risk and the diesel-related fraction in source apportionment studies.

Keywords: Contaminants - Other, Medium - Air

RP1-25

Characterization of Dermal Absorption Following Decontamination via Washing

E. C. Kilcline, J. Shirai, J. C. Kissel; U of Washington, Seattle, WA

Abstract: Under current worker protection regulations and agricultural risk assessment paradigms, washing is assumed to be an effective method for removal toxic substances such as pesticides from the skin. These assumptions are based on accumulated experimental data and general chemical principles. However, washing also increases dermal hydration, which has been shown to change the effectiveness of the skin as a barrier. This in turn could alter transport of chemicals through the skin. Some investigators have argued that washing may be contraindicated under some circumstances, complicating advice to laborers. In order to further clarify the effect of washing on dermal absorption, an extensive literature review was conducted on existing washing studies. Studies using human volunteers or skin and multiple exposure durations provided the most applicable information. Original data are have also been generated via an exposure study that investigates the effect of washing on the dermal absorption of the insect repellent N,N-Diethyl-meta-toluamide (DEET). In this study, human subjects were exposed to a low or high loading level of DEET (5 or 30 µg/cm2 of skin) for either 10 or 40 minutes. Following the exposure period, the contaminated skin was washed with either water only, a 5% (v/v) soap and water solution or a 10% (v/v) ethanol and water solution. Twenty-four hour urine samples were collected for 5 days and are being analyzed for DEET parent compound and metabolites to determine the amount of chemical absorbed. Available washing data are also being evaluated using an original model of skin decontamination developed in MATLAB®. That model permits examination of post exposure chemical transport to an aqueous surfactant solution placed on the skin.

Keywords: Exposure assessment, Exposure modeling

RP1-26

Indoor-Outdoor Differences in Ultrafine Particles in Homes Near a Highway

C. H. Fuller[1], J. L. Durant[2], P. Williams[1], D. Brugge[3], J. Spengler[1]; [1]Harvard School of Public Health, Boston, MA, [2]Tufts University School of Engineering, Medford, MA, [3]Tufts University School of Medicine, Boston, MA

Abstract: Introduction. Recent studies have shown that concentrations of ultrafine particles (UFP; aerodynamic diameter <0.1 micrometer) are elevated near highways. We are studying the relationship between UFP exposure and cardiovascular health in older adults who live near major highways in the Boston (MA, USA) area. As part of this study we sought to characterize UFP infiltration in homes in Somerville (just north of Boston) near Interstate-93 (>1.5 x 105 vehicles/day). Methods. Study participants lived either within 33-406 m of the highway or in an urban background site 1000-1483 m from the highway. We monitored indoor and outdoor particle number concentration (a proxy for UFP), temperature and housing characteristics. Separate indoor and outdoor sampling lines of ~2 feet drew air to the instrument. A solenoid valve switched air flow between lines at ~15-minute intervals. We calculated indoor-outdoor ratios from hourly-averaged UFP data. Results. Monitoring was completed at 18 homes over a period of 6 months with a median monitoring time of 14 days per home (range: 7-20 days). After excluding 2 homes due to persistent indoor sources, the median indoor-outdoor UFP ratio for all sampling times was 0.94, with hourly ratios ranging from 0.06 to 6.47. Fourteen homes were equipped with window-mounted or central air conditioning. Median ratios for homes with central air conditioning (0.55) or window-mounted units (0.90) were lower than homes without air conditioning (1.08). In homes without central air conditioning, increasing distance from the highway was associated with decreasing ratios, 0.81 for the urban background and 1.02 for < 100m, suggesting that infiltration rates decrease as outdoor levels go down. Conclusions. In our sample the median indoor-outdoor ratio of UFP was ~1, which implies that highway-related UFP easily migrate into the indoor environment. Preliminary analyses show that proximity to the highway increases ratios while air conditioning reduces ratios.

Keywords: Contaminants - Particulate matter, Indoor environment