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Title: *Chemical Speciation of Biomass Burning from Shrubland Sagebrush Ecosystem Vegetation*

Component: Fire Emissions and Atmospheric Aging (FEAA)

Advisor: Andrey Khlystov, Ph. D.

Wild and prescribed fires occur throughout the western and central United States. Over 60% of the landscape in this area is constituted by shrubland and grassland vegetation. The purpose of this study is to determine the emission factors from burning of vegetation of sagebrush ecosystem as few studies have investigated the fire emissions from these landscapes. Four common sagebrush ecosystem shrubland fuels were used: sagebrush (SB), bitterbrush (BB), rabbitbrush (RB), and horsebrush (HB). The experiments were performed in an 8 m³ burning chamber at DRI combustion facility. Samples were collected for analysis of various chemical classes, such as: i) carbonyls, ii) terpenes, iii) volatile organic compounds (VOCs), and iv) polycyclic aromatic hydrocarbons (PAHs). Carbonaceous aerosols were collected for fresh and aged biomass burning smoke. Collected samples for carbonyls were extracted and analyzed using high performance liquid chromatography coupled with a photodiode array detector (HPLC-PDA); while for the other classes, the collected samples were extracted and analyzed using gas-chromatography coupled with mass spectrometry (GC-MS). Online instruments, such carbon monoxide and carbon dioxide sensors were used to calculate the modified combustion efficiency to obtain the carbon-based emission factors. For carbonyl compounds, HB showed higher formaldehyde (5 ± 3 g/kgC) and acetaldehyde (4 ± 2 g/kgC) emissions, followed by BB, SB, and RB. A similar trend was shown for carbonaceous aerosols. Organic carbon concentrations increased after aging. Among terpenes compounds, highest emissions of alpha-pinene, camphene and eucalyptol were measured for SB; while for RB and HB, beta-myrcene and beta-pinene showed higher emissions. Among PAHs, highest emissions were measured for naphthalene, followed by fluorene and phenanthrene, especially for SB ($7 \times 10^{-4} \pm 9 \times 10^{-4}$ g/kgC). Aging reduced PAH concentrations. For example, for SB and RB, naphthalene emissions were reduced by 43% and 21%.