Ph.D. Defense Announcement
Katelyn O'Dell
June 25, 2021 at 10:00 a.m.

Katelyn O'Dell
Ph.D. Defense

Friday, June 25, 2021
10:00 a.m.

Defense
Virtual (full Teams link below)

Post Defense Meeting
Riehl Conference Room (211 ACRC)

Committee:
Jeffrey Pierce (Adviser)
Emily Fischer (Co-adviser)
Bonne Ford
Jeffrey Collett
Sheryl Magzamen (Environmental and Radiological Health Sciences)

Health-Relevant Pollutants in US Landscape Fire Smoke: Abundance, Health Impacts, and Influence on Indoor and Outdoor Air Quality

Landscape fire smoke is a complex mixture of multiple gas- and particle-phase pollutants, which are harmful to human health. The health impacts of landscape fire smoke may differ from urban pollution as the seasonal and spatial distribution, particle size distribution and composition, and relative abundance of gas-phase species in landscape fire smoke are different from urban pollution sources. Epidemiology studies of smoke exposure, which often rely on outdoor fine particulate matter (PM2.5) concentrations as a smoke exposure tracer, show smoke negatively impacts respiratory health. However, health impacts of many other harmful pollutants in smoke and impacts of smoke on indoor air are far less characterized. In this dissertation defense, I will first present a quantification of the abundance and health impacts of multiple health-relevant pollutants in US landscape fire smoke from 2006-2018. This work uses a combination of surface PM2.5 monitors and observations from an aircraft-based field campaign to quantify exposure to smoke-specific PM2.5 and gas-phase hazardous air pollutants (HAPs). Then, I will present an assessment of the influence of landscape fire smoke on indoor air quality in several western US cities using observations from the PurpleAir low-cost sensor network.

I find the largest contributors to the health risk from gas-phase HAPs in smoke are acrolein, formaldehyde, benzene, and hydrogen cyanide. The gas-phase HAPs health risk, normalized by PM concentration, decreases as the smoke ages in the atmosphere. Overall, the health risk from these gas phase HAPs in smoke is approximately three orders of magnitude lower than that from smoke PM2.5. I find a majority of US health impacts (approximately 75%) attributable to smoke PM2.5 occur outside the West. However, a higher percent of state-total health impacts is attributable to smoke in heavily fire impacted northwestern states, relative to other US states. Finally, I show that in several western US cities, daily average indoor PM2.5 concentrations are higher on smoke-impacted days, relative to smoke-free days, but remain lower than outdoor PM2.5. In addition, on smoke-impacted days, indoor PM2.5 concentrations increase as outdoor PM2.5 Air Quality Index (AQI) increases, but the ratio of indoor PM2.5/outdoor PM2.5 decreases. These results indicate awareness and informed mitigation of landscape fire smoke exposure is important across the US, not just in regions in proximity to large wildfires.

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