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Authors
Vance, ME
Farmer, DK
Novoselac, A
et al.

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An overview and early results from the HOMEChem Indoor Air Chemistry Field Campaign.

Marina E. Vance[1,*], Delphine K. Farmer[2], Atila Novoselac[3], Richard Corsi[3], Lea Hildebrandt Ruiz[3], Jon Abbatt[4], Peter F. DeCarlo[5], Philip Stevens[6], Tara F. Kahan[7], Allen H. Goldstein[8], William W. Nazaroff[8], Jose L. Jimenez[1], Paul J. Ziemann[1], Rob Knight[9], Pieter C. Dorrestein[9] and the HOMEChem team of students and researchers.

[1] University of Colorado Boulder, Boulder, USA
[2] Colorado State University, Fort Collins, USA
[3] University of Texas at Austin, Austin, USA
[4] University of Toronto, Toronto, Canada
[5] Drexel University, Philadelphia, USA
[6] University of Indiana Bloomington, Bloomington, USA
[7] Syracuse University, Syracuse, USA
[8] University of California at Berkeley, Berkeley, USA
[9] University of California San Diego, San Diego, USA
[*]*Corresponding email: Marina.Vance@colorado.edu*

SUMMARY
The HOMEChem (House Observations of Microbial and Environmental Chemistry) is a collaborative indoor air chemistry field study to be performed in June 2018 at the UTest House, a manufactured research house located in the University of Texas at Austin's research campus. The HOMEChem experiment investigates the effects of building occupants and their activities, such as cooking and cleaning, on the chemistry of the gas phase, particle phase, and surfaces in a simulated home environment. Specifically, this study focuses on the presence of organic species, chemical oxidants, and reactive nitrogen species indoors compared to outdoor levels. This study incorporates state-of the art atmospheric chemistry instrumentation from multiple research groups to build a shared dataset from those measurements.

KEYWORDS
Indoor Air Chemistry; Indoor Air Quality; Household; Human Activity; Aerosols.

1 INTRODUCTION

Few comprehensive field experiments have focused on indoor air chemistry. To the best of our knowledge, no simultaneous measurements of radicals, speciated gas-phase organic compounds using multiple chemical ionization techniques, aerosol composition, and surface characterization for organic matter and microbial metabolites have taken place in an indoor environment. Several studies have independently demonstrated the impact of cleaning and cooking activities to indoor air quality concerning specific pollutant categories (Abdullahi et al., 2013; Nazaroff and Weschler, 2004). Human presence has also been shown to alter the chemistry of indoor environments through direct emissions from the body and personal care products, as well as through reactions between ozone and skin oils (Wisthaler and Weschler, 2010). Occupancy may also affect the distribution of air, moisture, and light through the indoor environment, influencing reaction rates and altering the fate and transport of chemical species.

The objective of this experimental campaign is to investigate the effects of building occupants and the performance of common household activities, such as cooking and cleaning, on the composition and chemistry of gas phase, particle phase, and surfaces in a simulated home

environment. This experiment is centered around three science questions: (1) What are the sources of chemical oxidants in the indoor environment, and how are they impacted by changes in light conditions and human activities? (2) What are the main sources of organic carbon in the indoor environment, and how does the physical and chemical transformation of organic carbon to secondary organic aerosol and other trace gas species change in response to human activities? (3) What are the sources of indoor reactive nitrogen, and to what extent is indoor nitrogen influenced by outdoor pollution?

2 METHODS

The HOMEChem field campaign will be undertaken in June, 2018 at the UTest House, a 111-m^2 manufactured research house located at the University of Texas at Austin's research campus. The kitchen is equipped with a gas stove and oven, and a dishwasher. Most large analytical instruments will be placed outside the house and will monitor both indoor and outdoor conditions. Two main categories of experiments will be performed (1) sequential experiments: cooking, cleaning, and other activities to be performed independently, and (2) layered experiments: in which cooking, cleaning, and other occupancy-related activities will be performed throughout the day, simulating household activities and allowing for interplay of emissions.

The home will be monitored continuously for gas-phase organic composition and trace gases (including NOx, HOx, HONO, O_3, CO, CO_2, and CH_4), particle-phase composition, aerosol size distributions, and spectral radiance. In addition, surface samples will be collected for posterior analysis of organic species and microbial metabolites. Building and environmental parameters such as temperature, relative humidity, air exchange rate as well as the outdoor weather conditions will also be monitored.

3 RESULTS AND DISCUSSION

HOMEChem contribute to these goals: (1) address important data needs of the Chemistry of Indoor Environments modeling community; (2) engage an array of researchers from across the building science, microbiology, atmospheric chemistry and environmental engineering communities; (3) determine how an 'outdoor atmospheric chemistry'-style field campaign can provide insight on indoor chemistry; (4) provide compelling narratives for community engagement activities; and (5) result in an array of chemical and physical data exemplary of the indoor environment and thus contribute to the foundation of a data archiving and analysis system.

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