



# Partitioning in a Broader Context: Implications to exposure to outdoor pollution events

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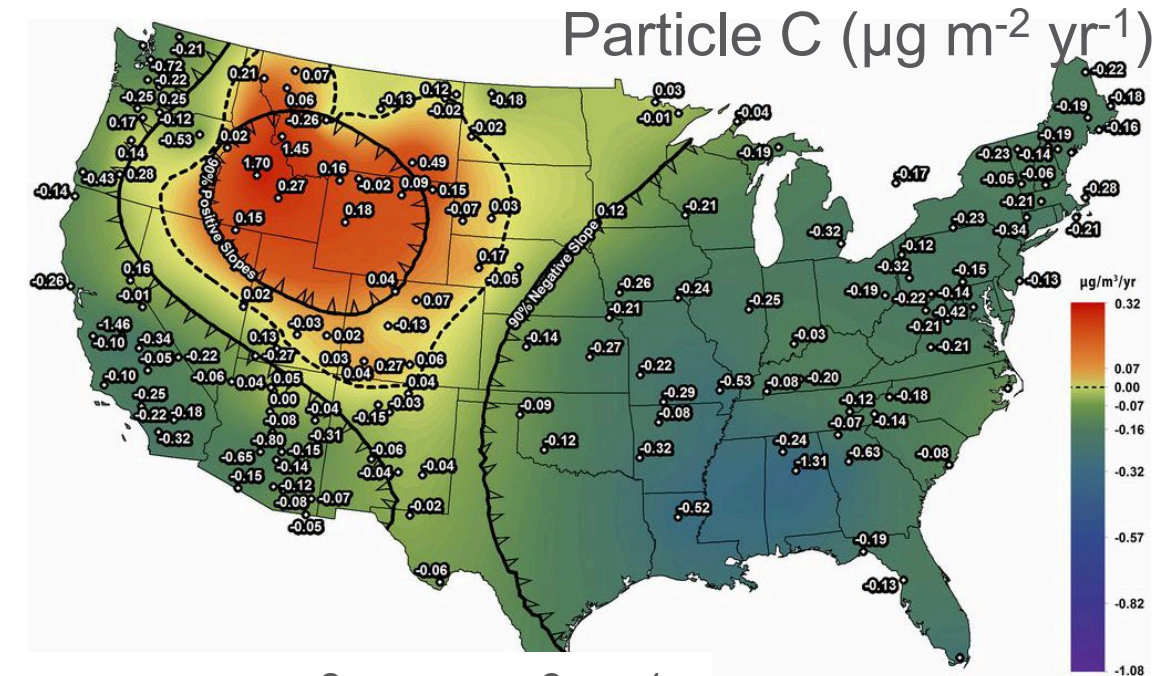
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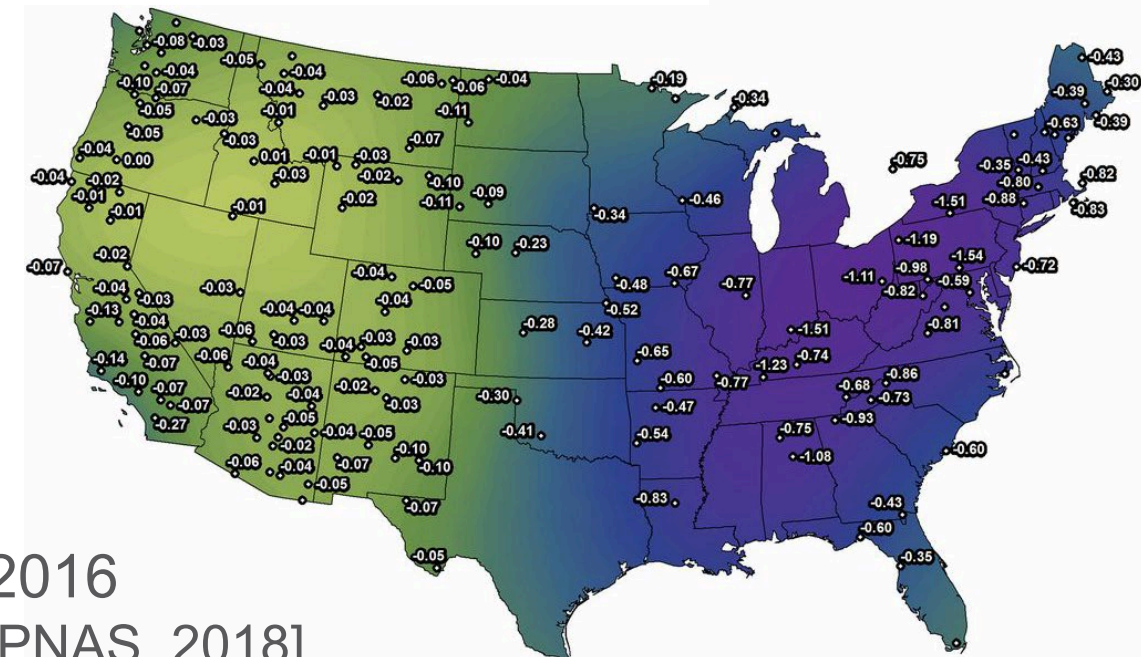
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# Wildfires – and their smoke– are increasingly prevalent

- Smoke influences both outdoor and indoor air quality  
[Henderson et al. JAWMA. 2012]
- Wildfires are influenced by changing climate, human behavior, land use, and forest management practices



Particle  $\text{SO}_4^{2-}$  ( $\mu\text{g m}^{-2} \text{yr}^{-1}$ )



PM Trends 1988-2016

[McClure and Jaffe. PNAS. 2018]





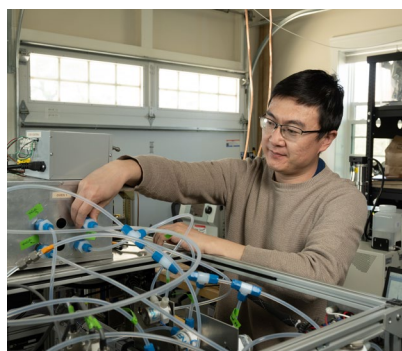
What happens when  
smoke gets indoors?

SCIENCE ADVANCES | RESEARCH ARTICLE

ATMOSPHERIC SCIENCE

# The persistence of smoke VOCs indoors: Partitioning, surface cleaning, and air cleaning in a smoke-contaminated house

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# How to add wildfire smoke without burning down a forest...



1. Find a piece of ponderosa pine wood and start chipping it...



2. Buy a cocktail smoker!



3. Give your friendly fire department a heads-up and release smoke!

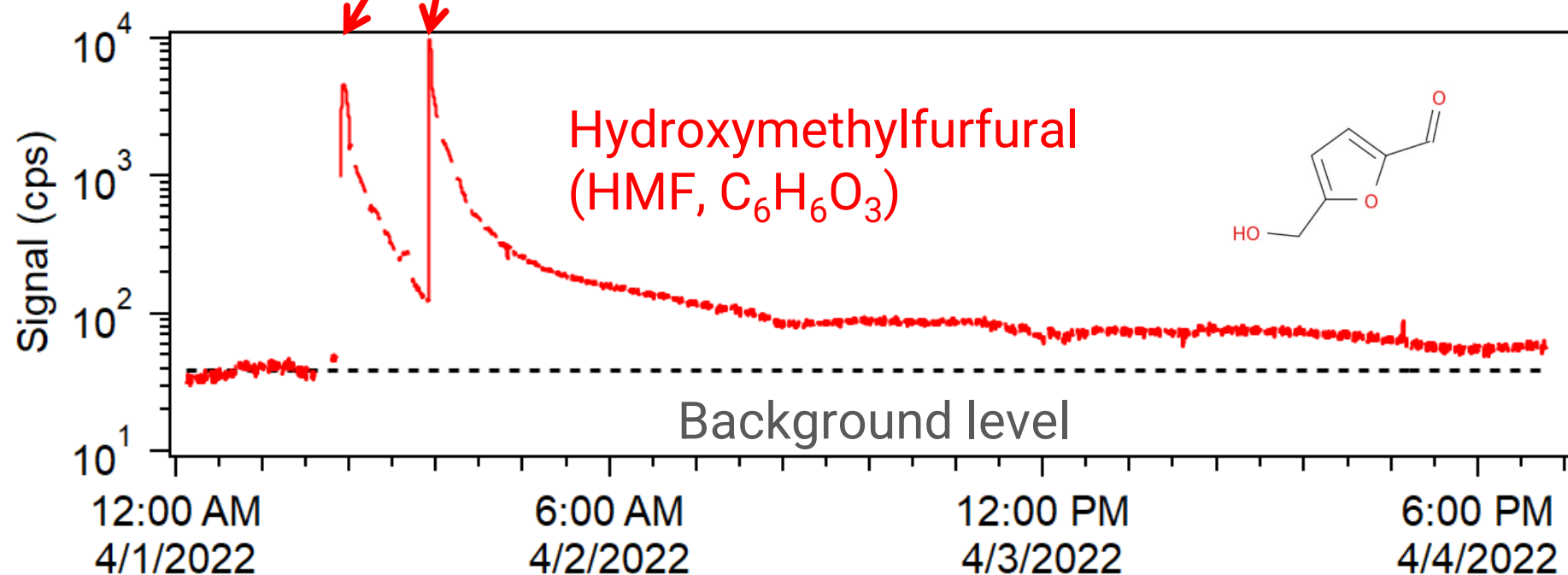




# Wildfire smoke VOCs persist indoors after the event

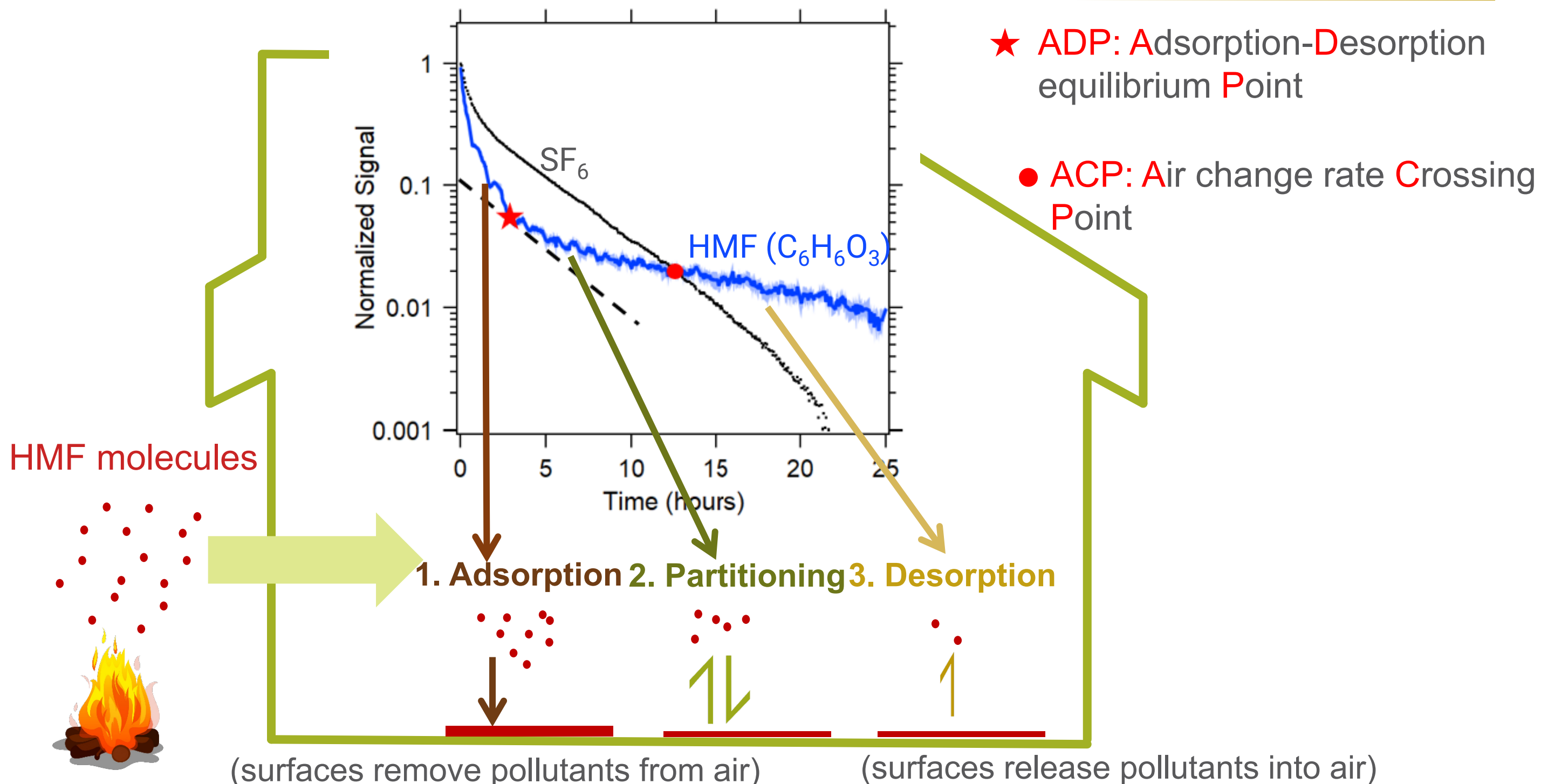


- Air levels never returned to background after smoke addition, even after days due to surface reservoirs
- But... we can watch the surface-air partitioning through [air]



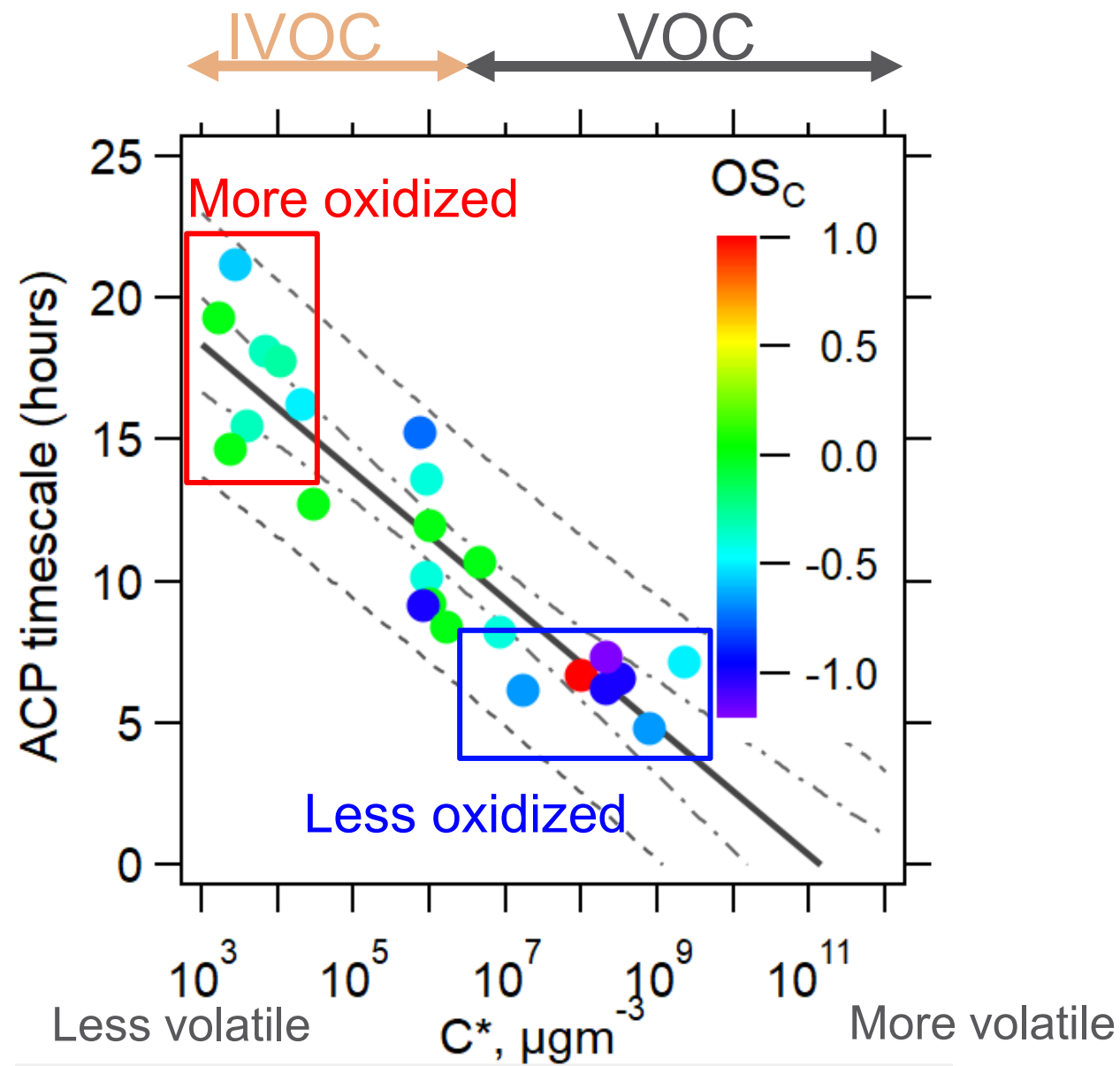
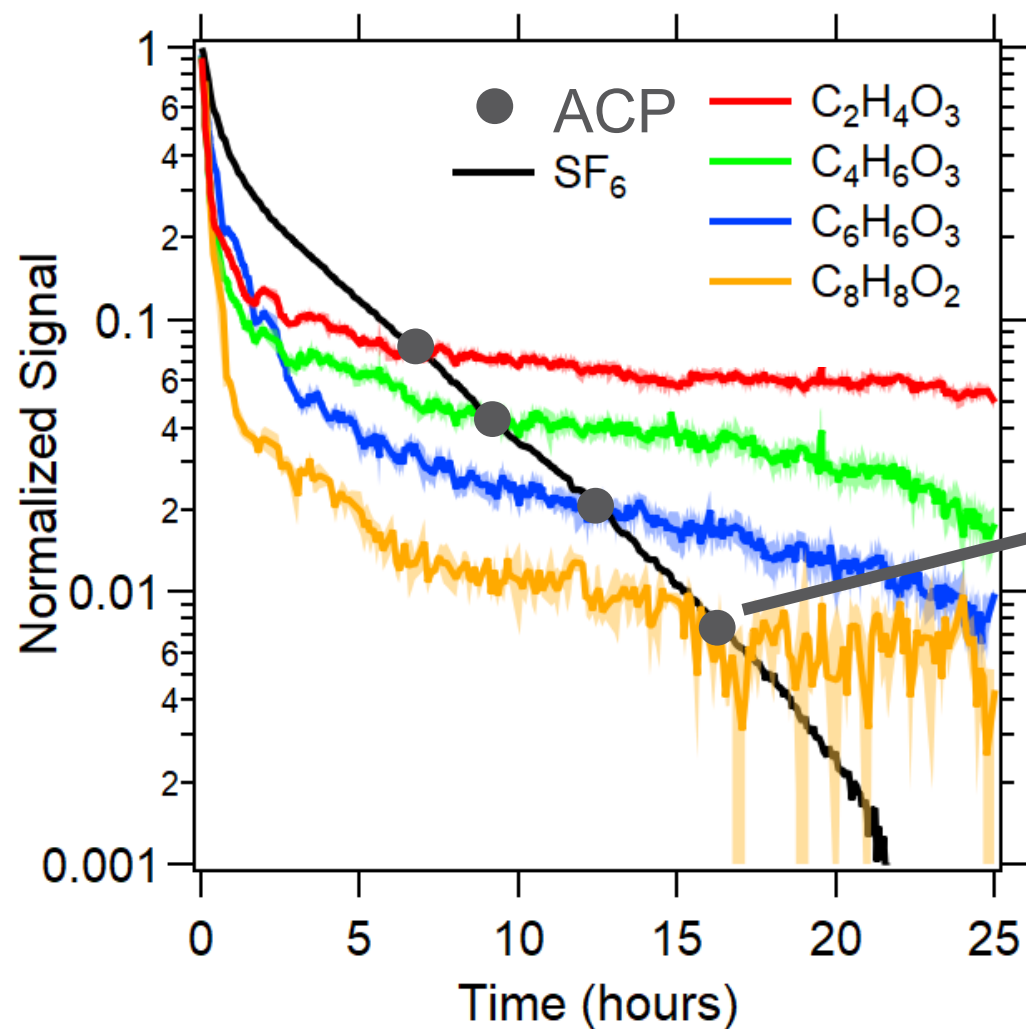


# Gases partition to indoor surfaces





# Chemical structure controls partitioning behavior

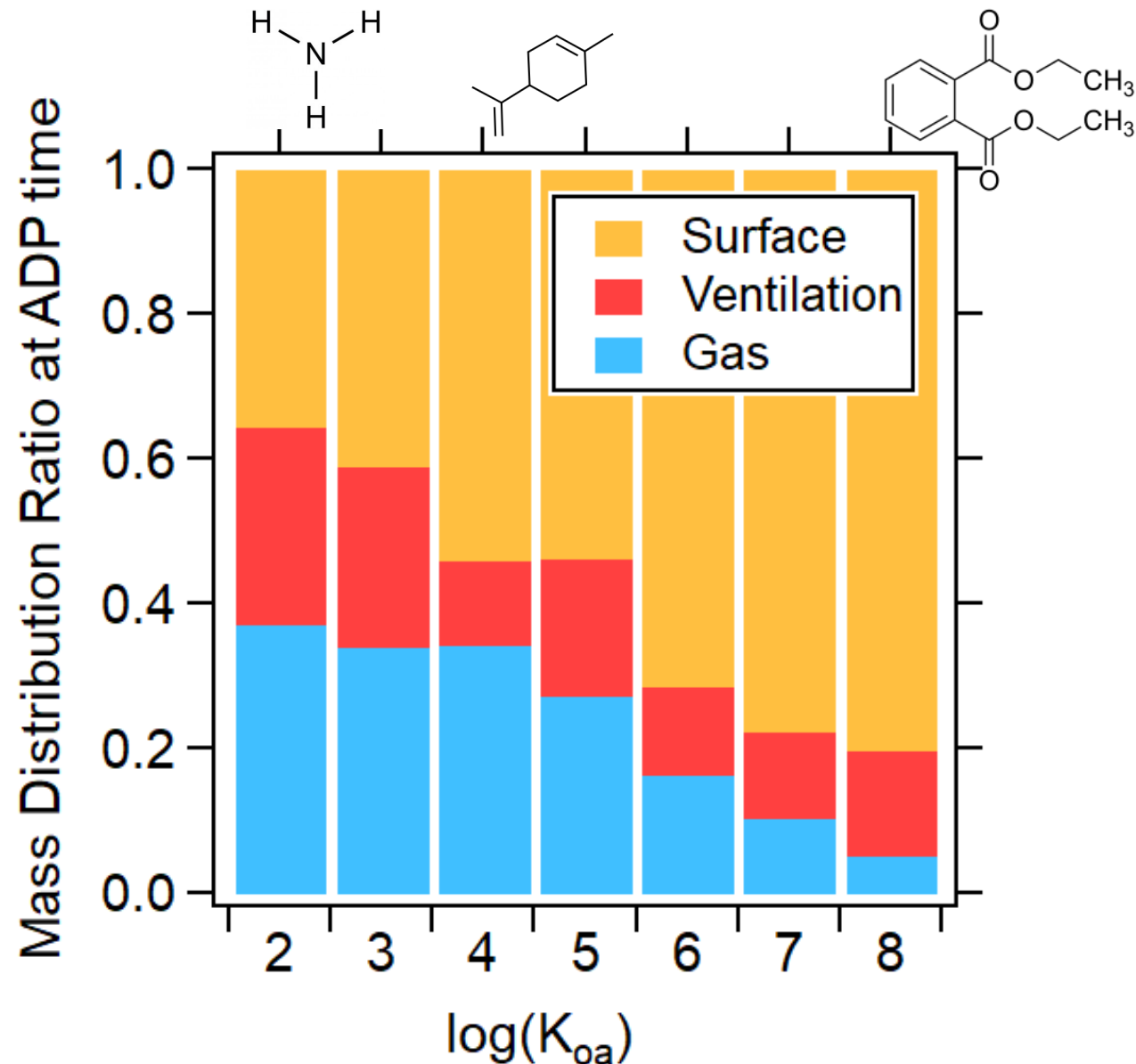
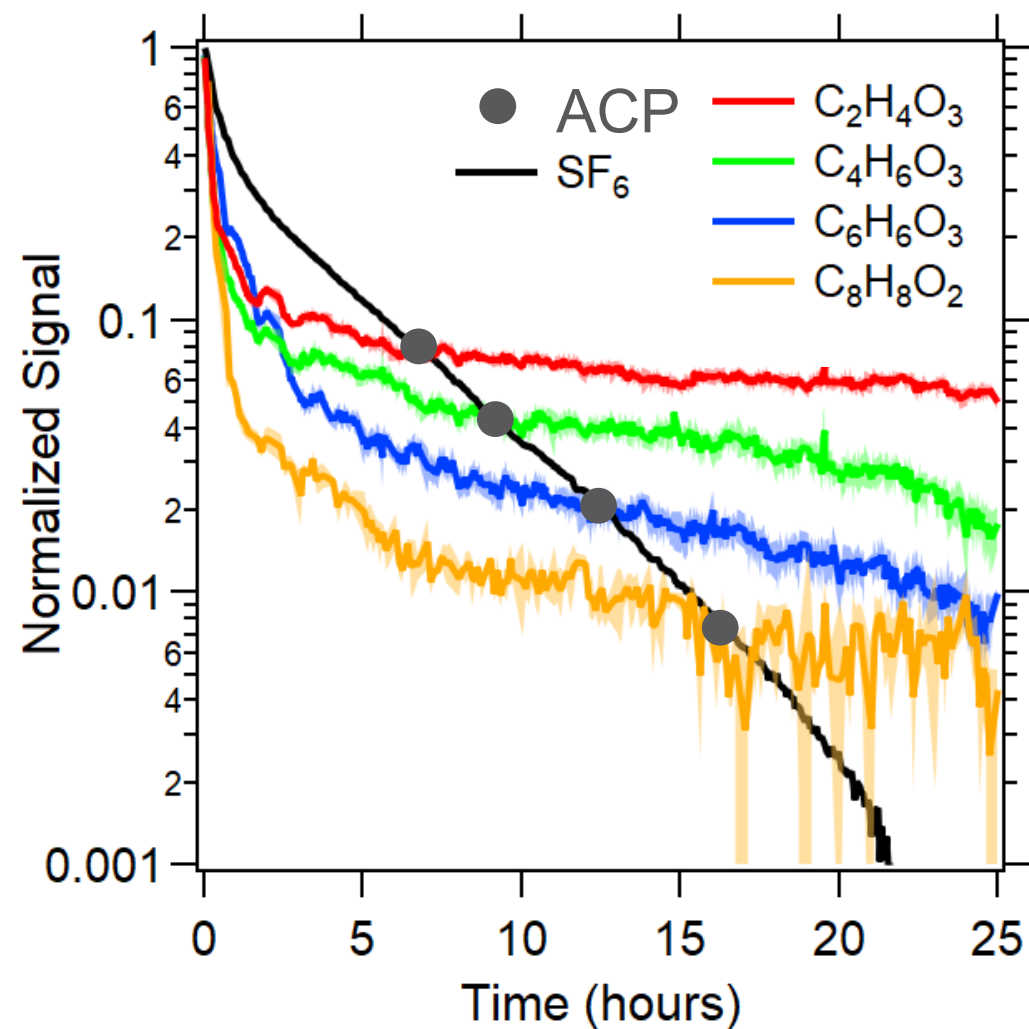


ACP: Air change rate Crossing Point

$C^*$ : Saturation concentration



# Chemical structure controls fate



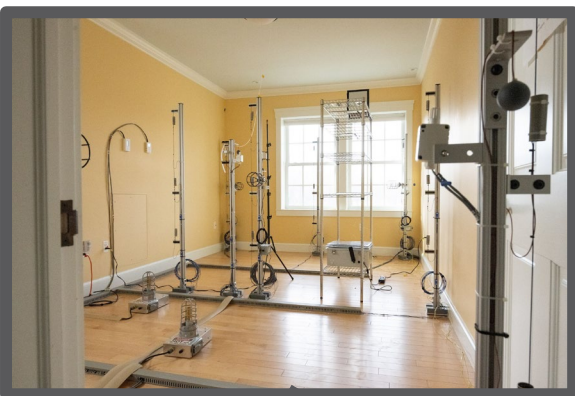
K<sub>oa</sub>: octanol–air partition coefficient





After a smoke event, high levels of organic compounds persist, but surface cleaning removes the reservoir and cleans the air

Empty House



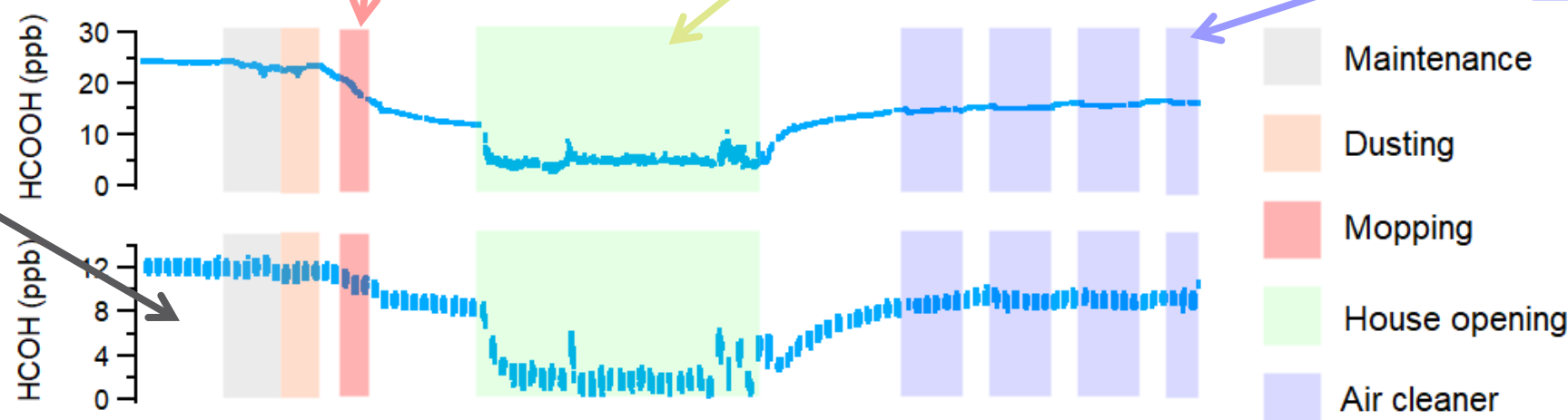
Cleaning



Windows Open



Air Cleaners



- What about fabric?
- What about more intense smoke events when one can't surface clean right away?
- Do different surfaces respond differently to smoke VOCs?

# Polycyclic Aromatic Hydrocarbons (PAHs) in Wildfire Smoke Accumulate on Indoor Materials and Create Postsmoke Event Exposure Pathways

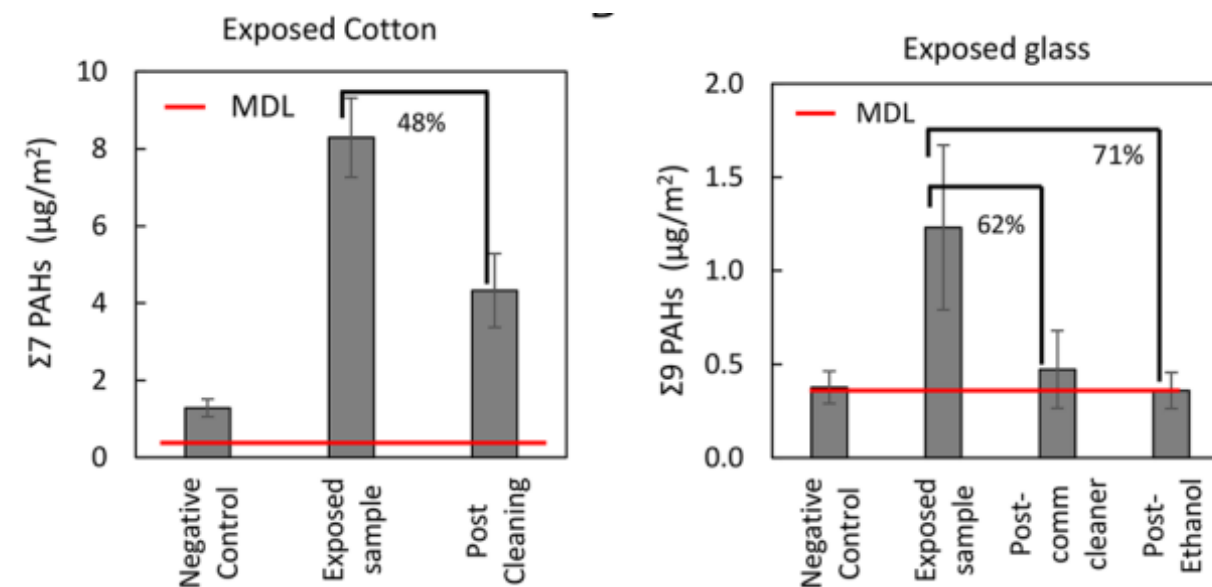
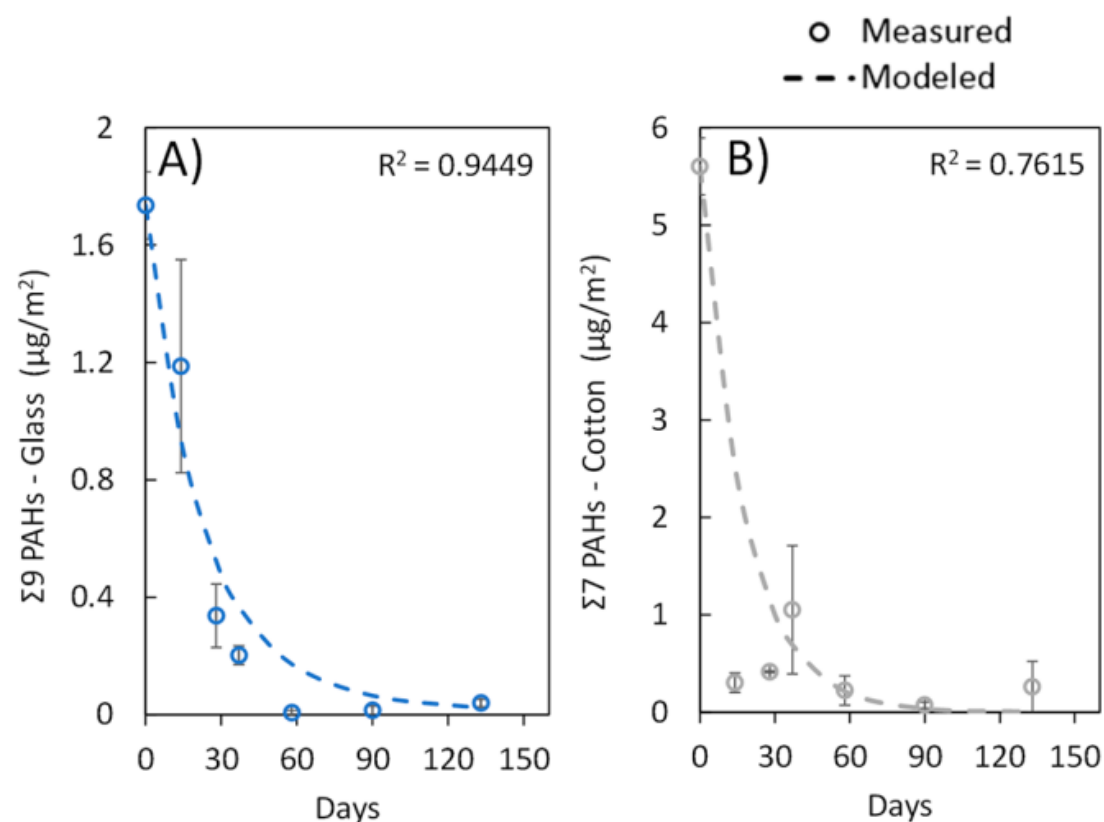
Aur lie Laguerre and Elliott T. Gall\*



Cite This: *Environ. Sci. Technol.* 2024, 58, 639–648



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- Fabric can hold on to smoke compounds strongly!
- Cleaning helps – a lot

# Volatile Organic Compounds Inside Homes Impacted by Smoke from the Marshall Fire

Published as part of ACS ES&T Air *special issue* "Wildland Fires: Emissions, Chemistry, Contamination, Climate, and Human Health".

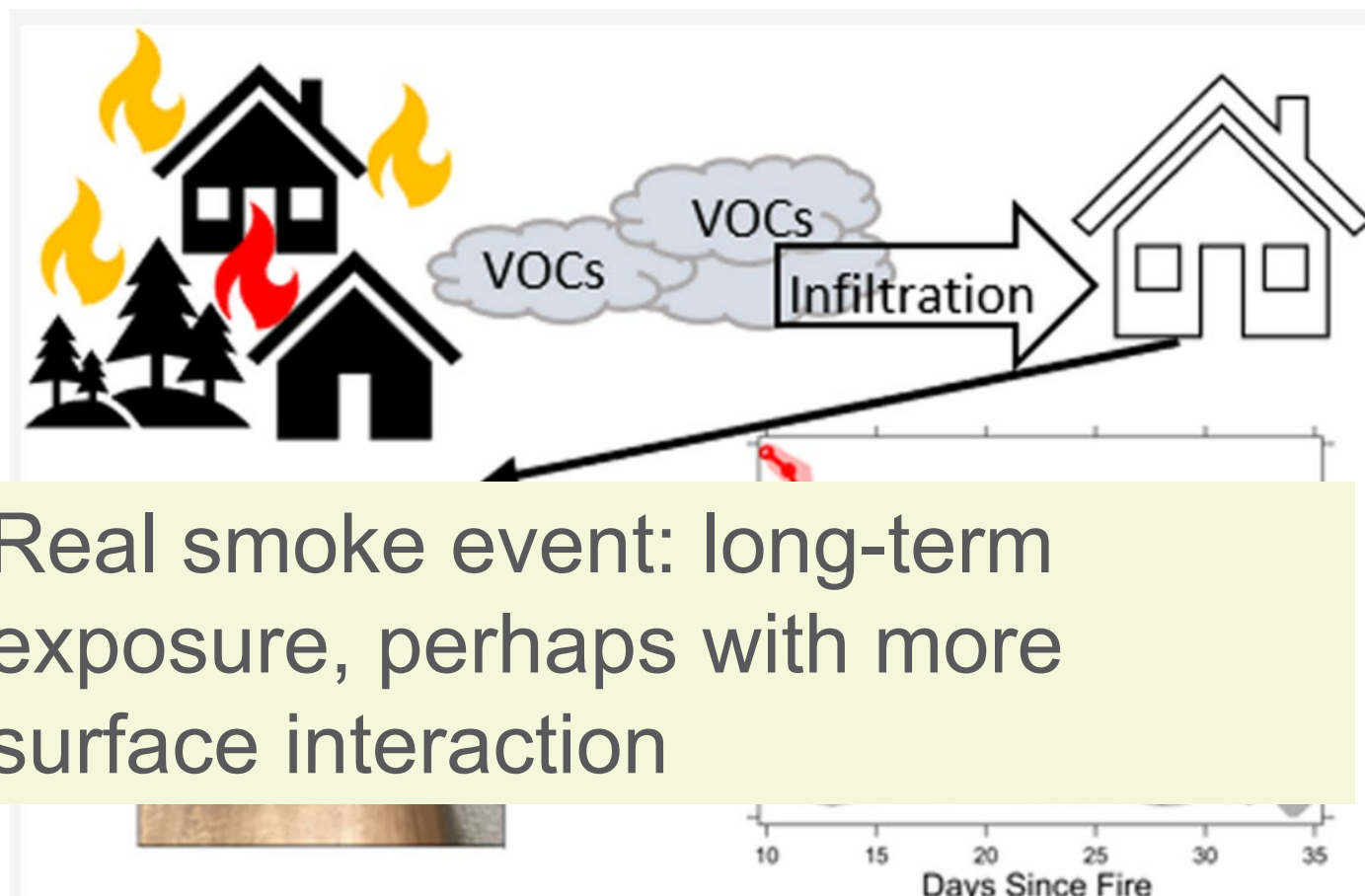
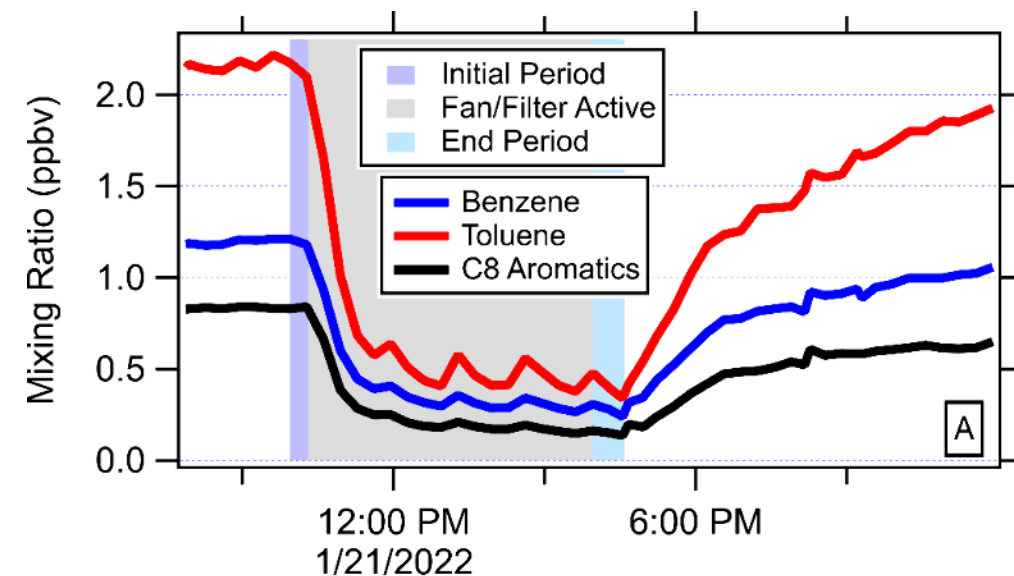
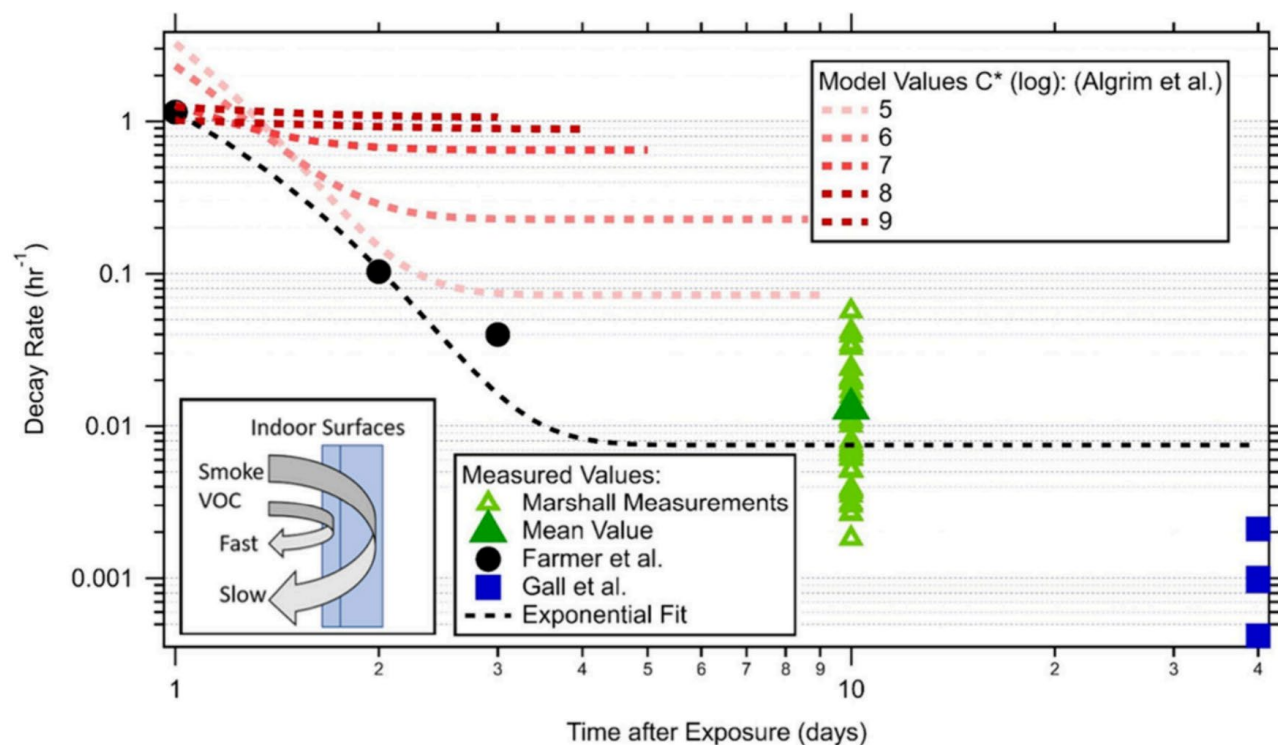
William D. Dresser, Jonathan M. Silberstein, Colleen E. Reid, Marina E. Vance, Christine Wiedinmyer, Michael P. Hannigan, and Joost A. de Gouw\*



Cite This: ACS EST Air 2025, 2, 4–12



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- Real smoke event: long-term exposure, perhaps with more surface interaction



- Different types of surfaces interact differently with smoke compounds
- Potential for chemical reactions on surfaces

# Chemical Transformations of Infiltrated Wildfire Smoke on Indoor-Relevant Surfaces

Published as part of *Environmental Science & Technology* special issue "Wildland Fires: Emissions, Chemistry, Contamination, Climate, and Human Health".

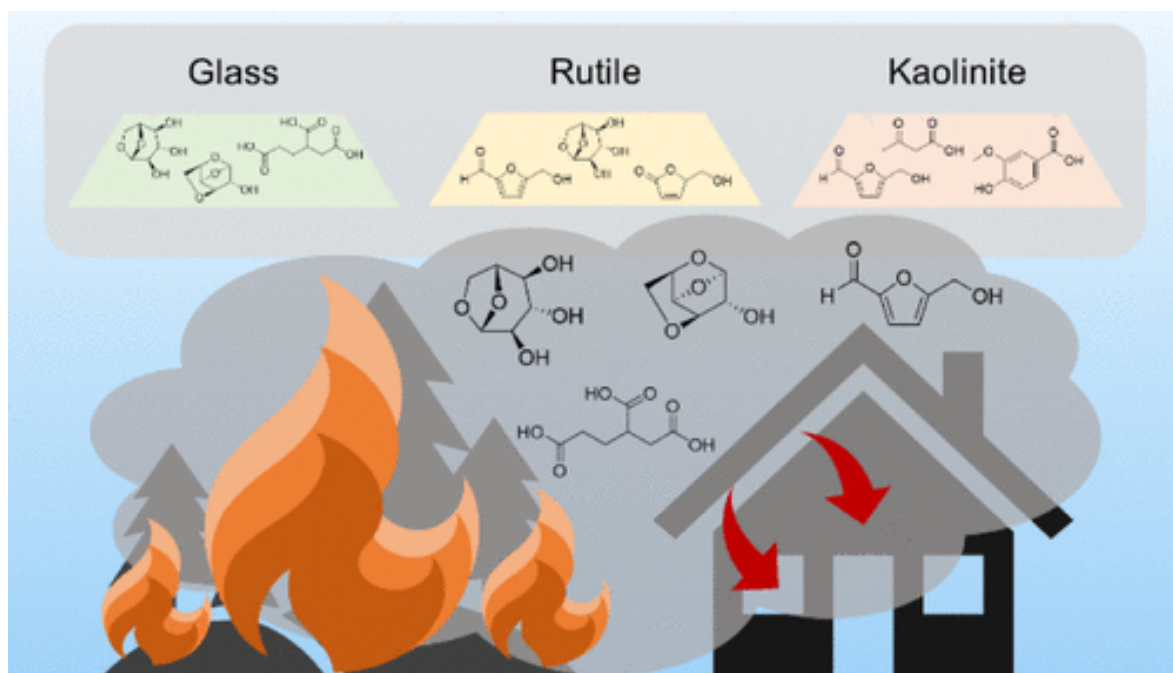
Cholaphan Deeleepojananan, Shubhrangshu Pandit, Jienan Li, Dylan A. Schmidt, Delphine K. Farmer, and Vicki H. Grassian\*



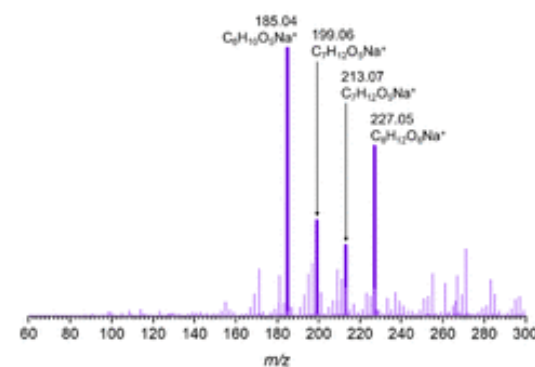
Cite This: *Environ. Sci. Technol.* 2025, 59, 8048–8059



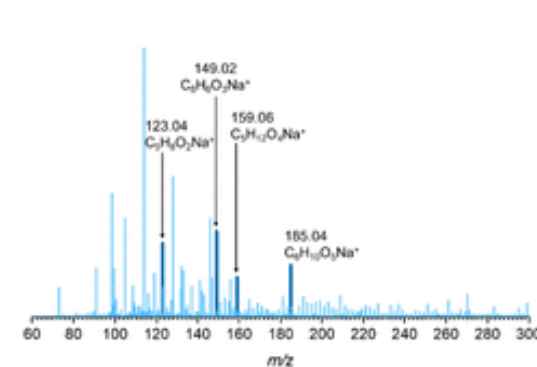
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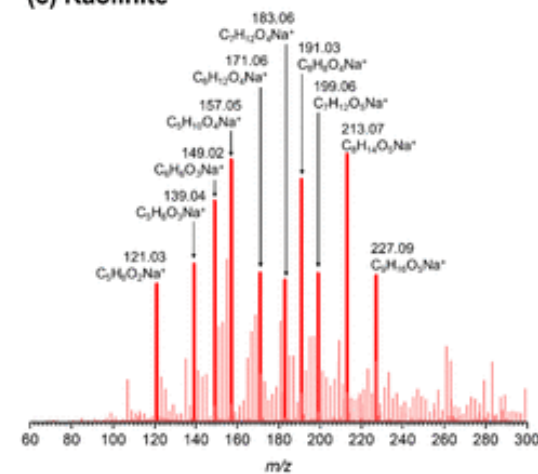
(a) Glass



(b)  $TiO_2$



(c) Kaolinite



# Reaction of HOCl with Wood Smoke Aerosol: Impacts on Indoor Air Quality and Outdoor Reactive Chlorine

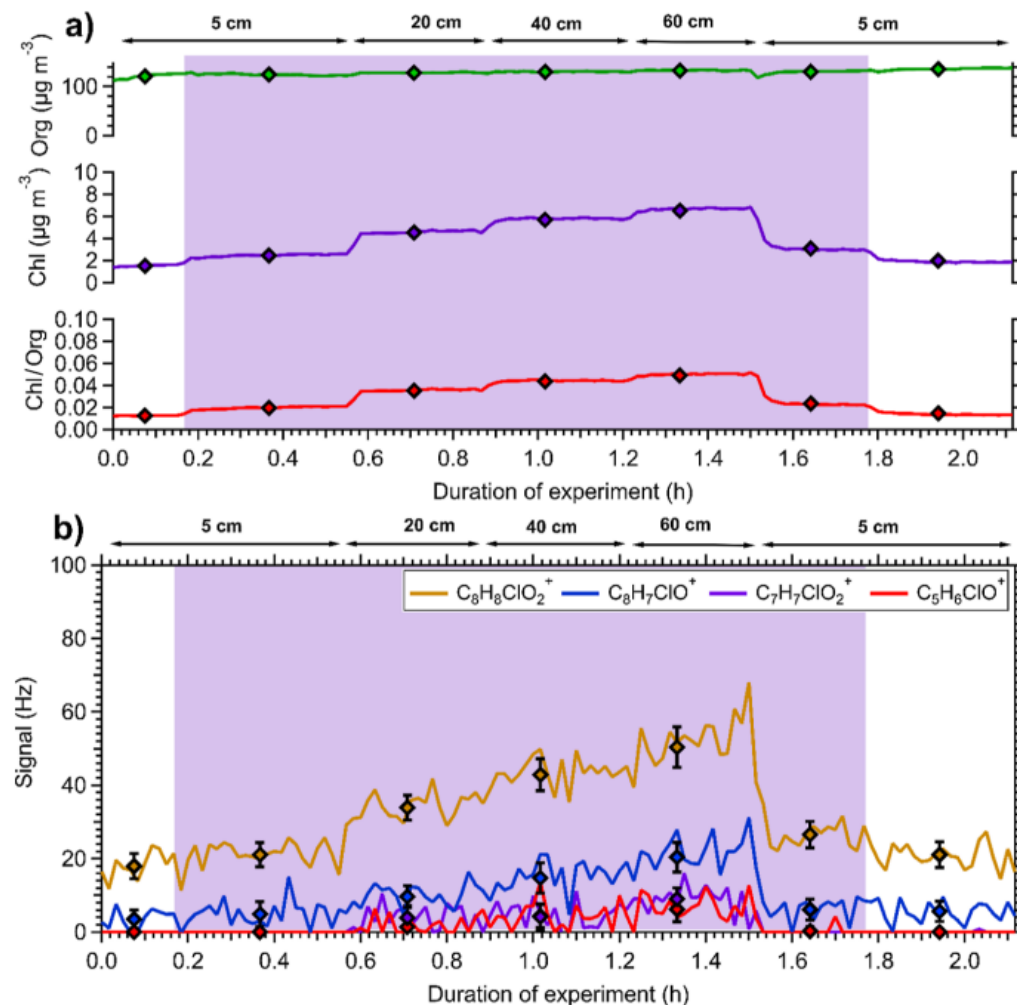
Spiro D. Jorga,\* Yutong Wang, and Jonathan P. D. Abbatt\*



Cite This: *Environ. Sci. Technol.* 2023, 57, 1292–1299



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- HOCl + smoke particles will generate chlorinated organic compounds
- Builds on large body of literature on bleach chemistry
- Be careful of chemical reactions when cleaning surfaces

Wildfire smoke (and other organics) form reservoirs on indoor surfaces, which become persistent sources of VOCs

Cleaning surfaces can remove some of these reservoirs; air cleaning impacts may be only temporary



Open question on timescales of cleaning versus permeation into surfaces





Partitioning is clearly a driver of indoor air quality

We need evidence-based guidance for responses to outdoor pollution events – and as the recent paper from Yu and Lakey show, indoor pollution sources



New York City has the worst air quality in the world as smoke from Canadian wildfires rolls in

# Railroad: Controlled release of chemicals in East Palestine derailment ‘completed successfully’

Ideastream Public Media | By Abigail Bottar  
Published February 6, 2023 at 2:44 PM EST  
Updated February 7, 2023 at 7:48 AM EST



▶ LISTEN • 0:45



Gene J. Puskar / AP

KCAL Cares  
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By Dean Fiorese  
Updated on: January 13, 2025 / 4:49 PM PST / CBS LA