

The University of Texas at Austin McKetta Department of Chemical Engineering Cockrell School of Engineering

Caltech Science Exchange webinar: Post-fire air quality

Impacts of the Los Angeles Fires on Air Quality and Exposure

Lea Hildebrandt Ruiz Associate Professor, The University of Texas at Austin lhr@che.utexas.edu



Spiegel Family Fund

SCHOOL OF PUBLIC HEALTH

May 2, 2025



The Los Angeles Fire Human Exposure and Long-Term Health Study (L.A. Fire HEALTH Study)

" a 10-year study of the Los Angeles fires to evaluate which pollutants are present, at what levels, and where, and to assess the respiratory, neurological, cardiovascular, reproductive, and immune system impacts of the wildfires"

Focus on the Eaton and Palisades fires

https://lafirehealth.org/



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LA Fire HEALTH Study

The wildfires in Los Angeles County in 2025 have brought devastating loss of life, homes, schools, businesses, communities, and mountain landscapes. Due to the smoke carried many miles by the plumes, the impacts of these fires extend far beyond the burned areas.

UT Austin Study Team



Albert Kyi, Daniel Sung, Katarina Konon, Morgan Meyer, Emmanuel J Thompson, Shihao Zhai, Lea El Khoury, Evelyn Deveraux, Colette Schissel, Yosuke Kimura, Chou Hsien Lin, Anna Neville, Chun-Ying Chao

Measurement Procedures



Vocus 2R Proton Transfer Reactions Mass Spectrometer (PTR-ToF-MS) Measures VOCs (gases)

Sampling in and around neighborhoods



Sampling in and around Altadena, CA on Feb 14, 2025

Levels of non-refractory PM₁ (NR-PM₁) vary by time of day



NR-PM₁ measured between 7.30-10 pm (μ g m⁻³)



Sampling in Pacific Palisades on Feb 15, 2025





Sulfate

Organics

Nitrate

Ammonium

Chloride

Sampling Inside of Homes



Indoor and outdoor concentrations

(After summing all species and averaging over indoor/outdoor periods)



Indoor / Outdoor Ratio – PM₁



Indoor / Outdoor Ratio – VOC (fire marker)



Summary and Future Work

- Impacts continue to impact indoor and outdoor air quality weeks after the fire
- PM concentrations were generally higher in Altadena than in the Palisades
- Indoor measurements show higher concentrations for damaged house in the burn zone.
- Analysis of data collected in February 2025 is continuing
- New measurements in May 2025 to evaluate impacts of clean-up efforts (debris removal), and evaluate continued indoor air quality impacts

https://lafirehealth.org/

Thank you!

David AllenLea Hildebrandt RuizPawel MisztalChEChECAEE







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PHOENIX

A dense air quality monitoring network focused on measuring airborne dust and ash in and around the burned areas of Altadena as a way of evaluating the ongoing dust mitigation activities.



Haroula Baliaka, Coleen Roehl, Paul Wennberg









How it started...







How it started...



Need for measurements: Most of the low-cost sensors that were reporting data from Altadena were lost in the fire

Need for data related to the larger particles (PM_{10}), indicative of local dust events, as Altadena recovers from the fire



Snapshot of map of **Purple Air** low-cost sensors taken in March





How it started... First conversations with QuantAQ **Jan 07 Feb 20**

Jan 29

Why focus on the larger particles?

- Fine particles (PM_{2.5}): Mostly dominated by regional background pollution
- activities and truck traffic leading to dust resuspension.



Eaton Canyon and

Palisades fires started



• Coarse particles (PM₁₀): Heavily influenced by local nearby activity; likely from cleanup



How it started...















PHOENIX







PHOENIX: Post-fire airborne Hazard Observation Environmental Network for Integrated Xposure-monitoring



Caltech PHOENIX

Post-fire airborne Hazard Observation Environmental Network for Integrated Xposure-monitoring

Caltech, in partnership with Altadena and Pasadena community members, is establishing an air quality monitoring network focused on measuring airborne dust and ash in and around the burned areas of Altadena. As of March 24, 2025, we have set up 25 sensors.



	PM _{2.5}	
Loorn more ()		

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PHOENIX: Post-fire airborne Hazard Observation Environmental Network for Integrated Xposure-monitoring



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Post-fire airborne Hazard Observation Environmental Network for Integrated Xposure-monitoring

Caltech, in partnership with Altadena and Pasadena community members, has established an air quality monitoring network of 28 sensors, focused on measuring airborne dust and ash in and around the burned areas of Altadena.



Last updated: May 1, 2025





PHOENIX: Preliminary results

Fraction of number of days (24h averages) in each **PM₁₀ category**





Good Moderate Unhealthy for sensitive groups Unhealthy Very unhealthy Hazardous

Categories based on 24h EPA limits





PHOENIX: Preliminary results

Snapshot from April 10th: Outer circle: PM_{10} , inner circle $PM_{2.5}$





		1

ΡΜ _{2.5} (µg/m³)	ΡΜ ₁₀ (μg/m³)
0-9	0-54
9.1-35.4	55-154
35.5-55.4	155-25
55.5-125.4	255-35
125.5-225.4	355-42
≥225.5	≥425









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Dust from trucks



Photos taken by Linda Marais









Minutes per day of higher PM_{10} concentrations





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If we go back in time though...



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Pico Rivera site





Limitations

Frequently Asked Questions (FAQs)

Below are some common questions about the PHOENIX air quality monitoring project.

What is PM_{2.5} and PM₁₀?

Does your sensor tell us about how toxic the aerosol is?

No, our sensors only tell us how much (mass) is there but not what the particles are made of.





JPL's Outdoor Air Quality Monitoring Sites



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Outdoor Traffic-Related Air Pollution Levels Black Carbon



and a strong marker of traffic pollution – especially diesel trucks.

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• Black carbon: an important component of outdoor particles, emitted by incomplete combustion sources



Outdoor Traffic-Related Air Pollution Levels Black Carbon



- and a strong marker of traffic pollution—especially diesel trucks.

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• Black carbon: an important component of outdoor particles, emitted by incomplete combustion sources

• Woodbury averages about 2x JPL, yet both are within the typical range seen elsewhere in Los Angeles.



Outdoor Traffic-Related Air Pollution Levels Ultrafine Particles ($PM_{0,1}$)

15-Minute Trends



also formed in the air through chemical reactions—another useful marker of traffic pollution.

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• Ultrafine particles: the tiniest airborne particles (< 0.1 μm), emitted by fresh combustion sources (e.g., vehicle exhaust) and

Outdoor Traffic-Related Air Pollution Levels Ultrafine Particles ($PM_{0,1}$)

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• Ultrafine particles: the tiniest airborne particles (< 0.1 μm), emitted by fresh combustion sources (e.g., vehicle exhaust) and

• Woodbury averages ~30% higher than the School site, yet both are within the typical range seen elsewhere in Los Angeles.

What's next?

We collected dust samples on Fair Oaks

Prof. Francois Tissot + team will analyze our samples

What's next?

Soon to be:

Deploying an instrument that monitors real-time PM_{10} metals and elements

Conversations After The Fires: Air Quality and Health

Rima Habre, ScD

Associate Professor Director, CLIMA Climate and Health Center Co-Director, NEXUS: Network for Exposomics in the U.S. Environmental Health & Spatial Sciences Institute University of Southern California habre@usc.edu

> CalTech Science Exchange May 2, 2025

What We Know, What We Don't Know

- WF's esp at WUI emit smoke and ash containing particles, gases, and VOCs that can be concerning for health (Plumlee et al, 2013)
- Many studies on acute and chronic health impacts of
 - Near and far (fresh and old) WF smoke
 - Natural and climate-related disasters in general incl wildfires Respiratory, cardiovascular, mental, cognitive, cancer, etc.
 - Still lots to be done!
- Much fewer studies on health impacts of cumulative, multimedia exposures of modern, urban fires (or all fires)
 - Beyond just smoke > mixtures of chemicals in ash, water, dust, soil, air
 - Modern life materials less well understood
 - Lingering exposures and risks

Maui Wildfires Exposure Study

Courtesy of Dr. Ruben Juarez and Dr. Alika Maunakea, University of Hawaii

- UHERO MauiWES Community Dashboard
 - Real-time findings and data visualizations on respiratory, cardiovascular, and mental health screening results
 - https://analytics.uhero.hawaii.edu/maui-wes/community-support/family-friends
- Drs. Juarez and Maunakea shared early lessons learned
 - Social support strongly moderates mental health outcomes

Individuals with low perceived support had nearly double the risk of suicidal ideation and elevated depression scores

- Exposures to lead, arsenic, and VOCs were measurable in a subset, particularly among those returning early to the burn zone
- Access to care was uneven, especially among immigrant populations

Fundamental Exposure Principles

FIGURE 6-1 Common exposure routes for chemicals in the indoor environment.

Overview of Our Work

Roxana Khalili, PhD (under review)

More WF days during preconception associated with greater risk of small-forgestational-age infant, with risks greater in more climate vulnerable neighborhoods. MADRES women experienced 130.5 wildfire days (SD 42.4, 0 to 211) during pregnancy (n=713) between 2016-2020.

New R01, Shohreh Farzan and Rima Habre, R01ES036185

Children's Cardiovascular Health in a Changing Climate: The Impacts of Extreme Heat and Wildfire Smoke

CLIMA Climate and Health Center

Methods Development Research Core (Sanders and Silva)

PI Habre, NHLBI P20HL176204, <u>www.clima.usc.edu</u>

Our Work – LA Fire Health Study / Eaton USC Study

LA FIRE HEALTH STUDY

- Consortium led by Dr. Kari Nadeau, Harvard TH Chan School of Public Health, funded by the Spiegel Family Fund
- Eaton Fire Exposure and Health Community Study
 - Pl's Habre, Farzan, Herting, Johnston
 - Supported by seed funding from USC President's Sustainability Award and from the LA Fire Health Study
 - Expected launch of first wave in June July 2025

Eaton Fire Exposure and Health Community Study

Personal monitoring wristband (Fresh Air Clip) for exposomics, Dr. Krystal Pollitt's lab Home air and dust sampling

Community neighborhood-scale air monitoring w JPL/Caltech partners

Biospecimens kit for exposomics, Dr. Kari Nadeau's lab Questionnaire based health assessments and reconstructing exposure histories (modeling)

Study Team

Rima Habre, ScD Shohreh Farzan, PhD Jill Johnston, PhD Megan Herting, PhD Jeff Gold, PhD Krystal Pollitt, PhD Elena Austin, ScD

- LA Fire Health Study Team
- Lisa Valencia, Lillian Liu, Roxana Khalili, Yan Xu, Carlos Cardenas-Iniguez
- JPL and Caltech collaborators
- Email <u>climactr@usc.edu</u> for study participation interest, follow updates and announcements on <u>https://clima.usc.edu/</u>

Important Resources

- Initial MauiWES Report (April 2024)
 - <u>https://uhero.hawaii.edu/wp-</u> <u>content/uploads/2024/05/MauiExposureS</u> <u>tudy.pdf</u>
- Why Indoor Chemistry Matters, NASEM report
- Plumlee et al, 2013

11.7 The Environmental and Medical Geochemistry of Potentially Hazardous Materials Produced by Disasters

GS Plumlee, SA Morman, GP Meeker, TM Hoefen, PL Hageman, and RE Wolf, US Geological Survey, Denver, CO, USA

Important Resources

LADPH Fire Safety and Health

- http://publichealth.lacounty.gov/media/wildfire/index.htm
- Eaton Fire Collaborative
 - <u>https://www.eatonfirecollaborative.org/</u>
- LA Fire Health Study
 - <u>https://lafirehealth.org/</u>
- CLIMA Center
 - <u>https://clima.usc.edu/</u>
- NEXUS Center
 - https://www.nexus-exposomics.org/

Thank You

- Contact Rima Habre, ScD <u>habre@usc.edu</u>
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 - Farzan Habre: R01ES036185
 - SCEHSC: P30ES007048

rimahabre

NEXUS Network for Exposomics in the U.S. Research Services