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# Filtration for Respiratory Exposure to wildfire Smoke from Swamp Cooler Air



# Conflicts of Interest

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No conflict of interest to disclose

# Disclaimer

This PowerPoint was developed in part under Assistance Agreement No. R84024201 awarded by the U.S. Environmental Protection Agency to the Public Health Institute. It has not been formally reviewed by EPA. The views expressed in this document are solely those of Gina Solomon and Nayamin Martinez and do not necessarily reflect those of the Agency. EPA does not endorse any products or commercial services mentioned in this publication.

# Nayamin Martinez, M.P.H.

Executive Director, CCEJN

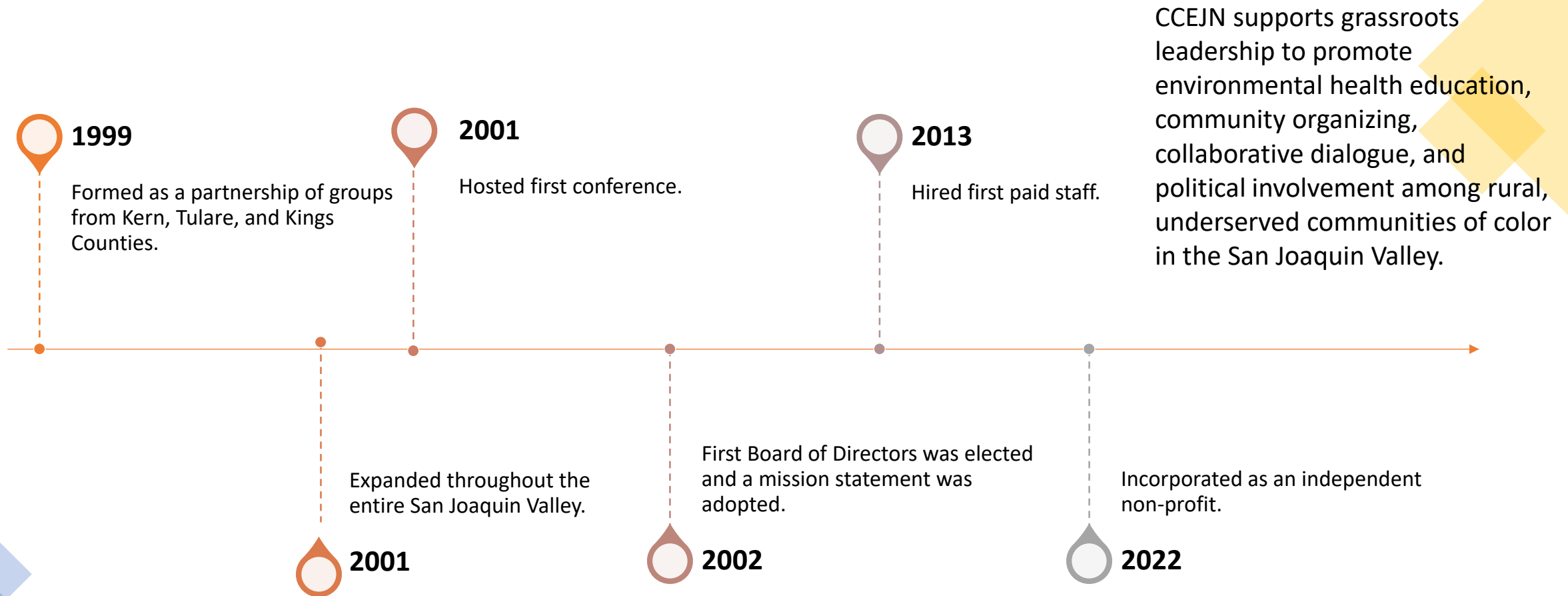
Nayamin worked for the Madera County Public Health Department as a Health Education Coordinator and for ten years was the Health Projects Coordinator for the Binational Center for the Development of the Oaxacan Indigenous Communities.





Multiple Sources of  
Outdoor Air Pollution in  
the Central Valley

# Central California Environmental Justice Network (CCEJN)



# Farmworker Ambassadors Program



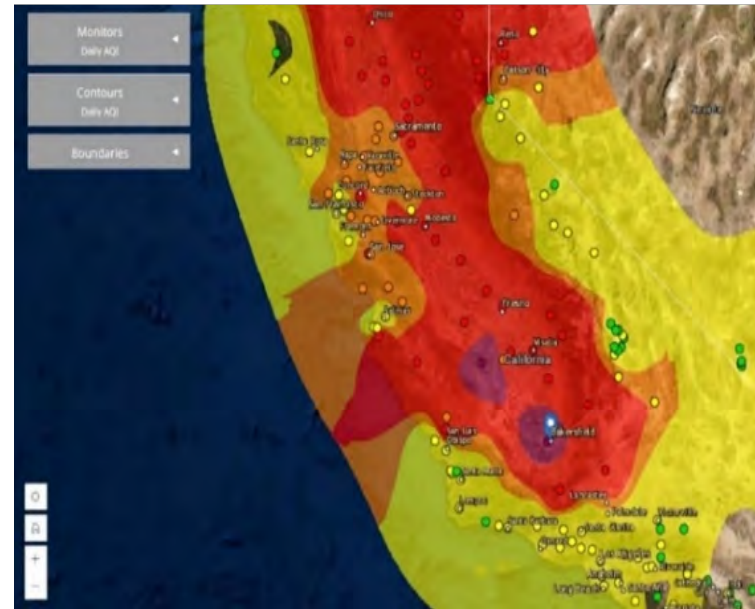
CCEJN educates farmworkers and residents of the San Joaquin Valley about the regulations that protect them from pesticide exposure, how to identify and report violations of these regulations, and, most importantly, how to advocate for stronger regulations and improved enforcement.

## Goals

1. Improve the ability of farmworkers and residents of rural communities to identify, monitor, and report pesticide exposure.
2. Train farmworkers on the legal provisions that protect them against pesticide exposure.
3. Engage farmworkers in advocacy campaigns that seek stronger regulations against pesticide exposure at the county and state level.

# Air Monitoring and Wildfire Smoke

- CCEJN has engaged since 2014 in multiple community air monitoring programs in the Valley.
- We use a variety of methodologies (i.e., grab samples/bucket samples, temporary stationary monitoring, permanent stationary monitoring).
- In 2019 and 2020 we heard concerns from community residents about smoke coming in through evaporative coolers (ECs).
- In partnership with Public Health Institute (PHI), we developed the FRESSCA project.



Air Quality Index for San Joaquin Valley  
August 22, 2020 (EPA AirNow, 2020)



# Project Goal

Reduce wildfire smoke exposures by designing, testing, and deploying an affordable and effective filtration system for residential evaporative (“swamp”) coolers.



Funded by EPA-G2021-STAR-G1, (#RD-84024201-0)

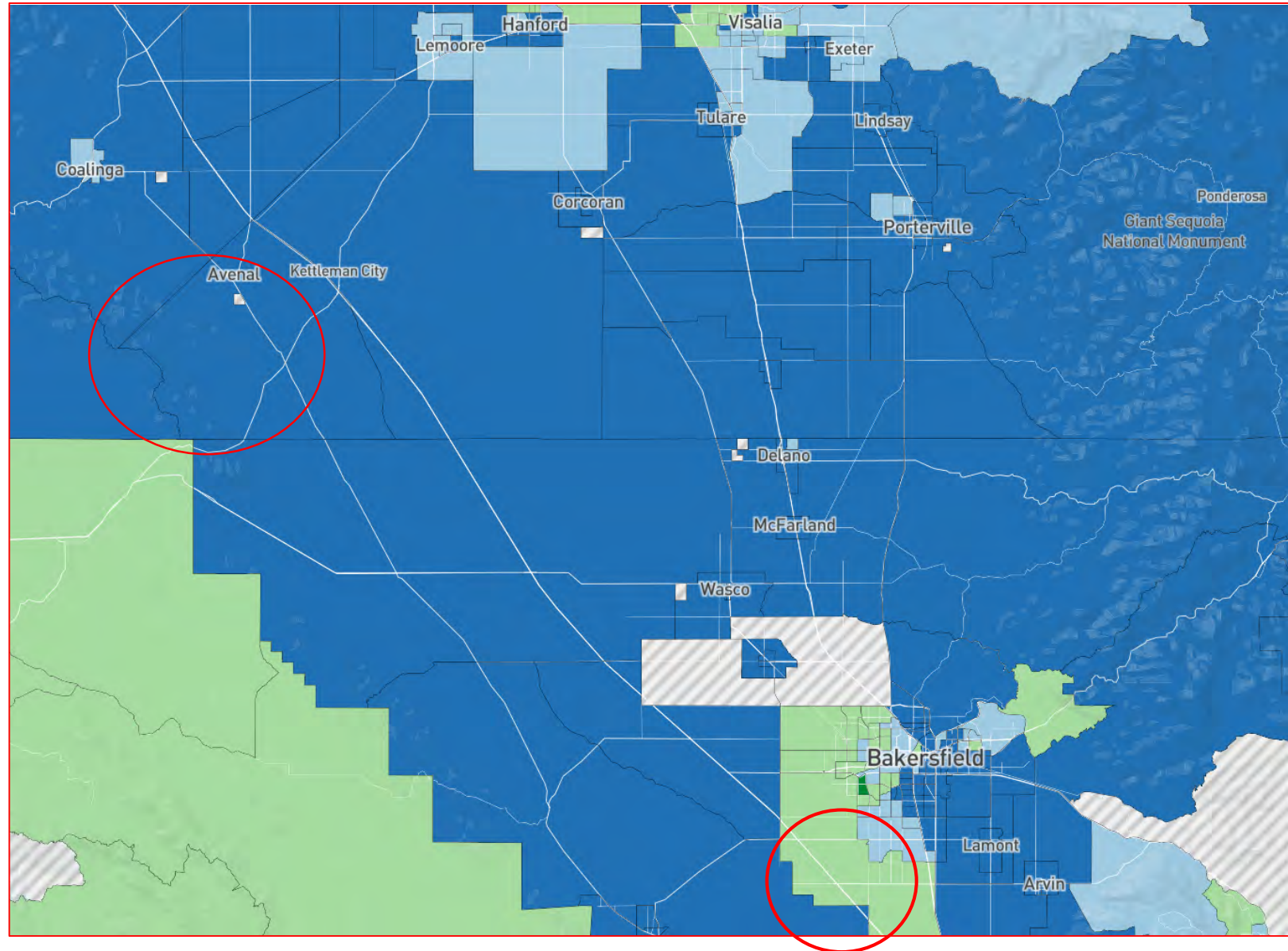
# Study Locations

- **Fresno County**

- Coalinga (Pop. = 16,534)
- Huron (Pop. = 6,300)
- Avenal (Pop. = 13,800)

- **Kern County**

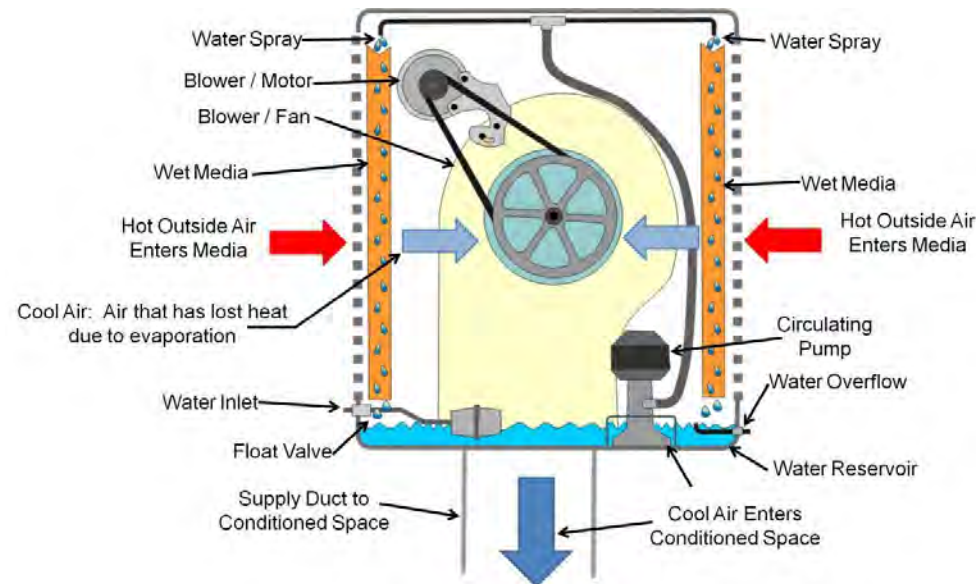
- Arvin (Pop. = 21,500)
- Lamont (Pop. = 15,100)



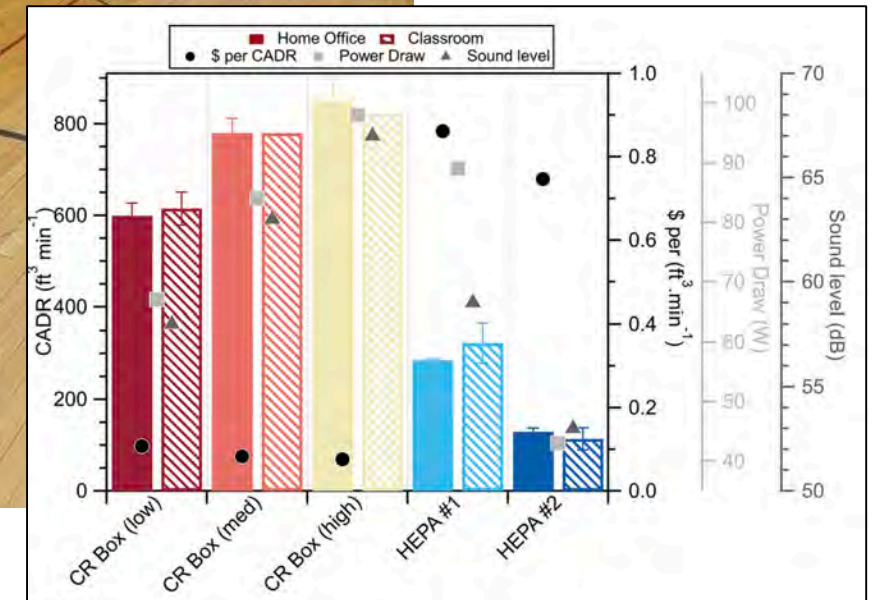
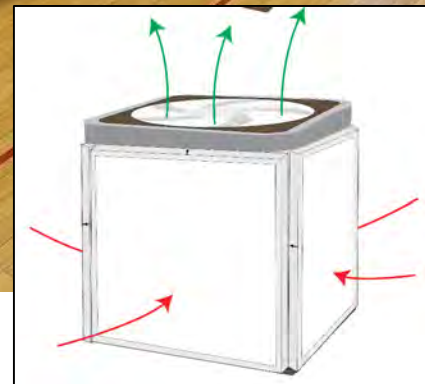
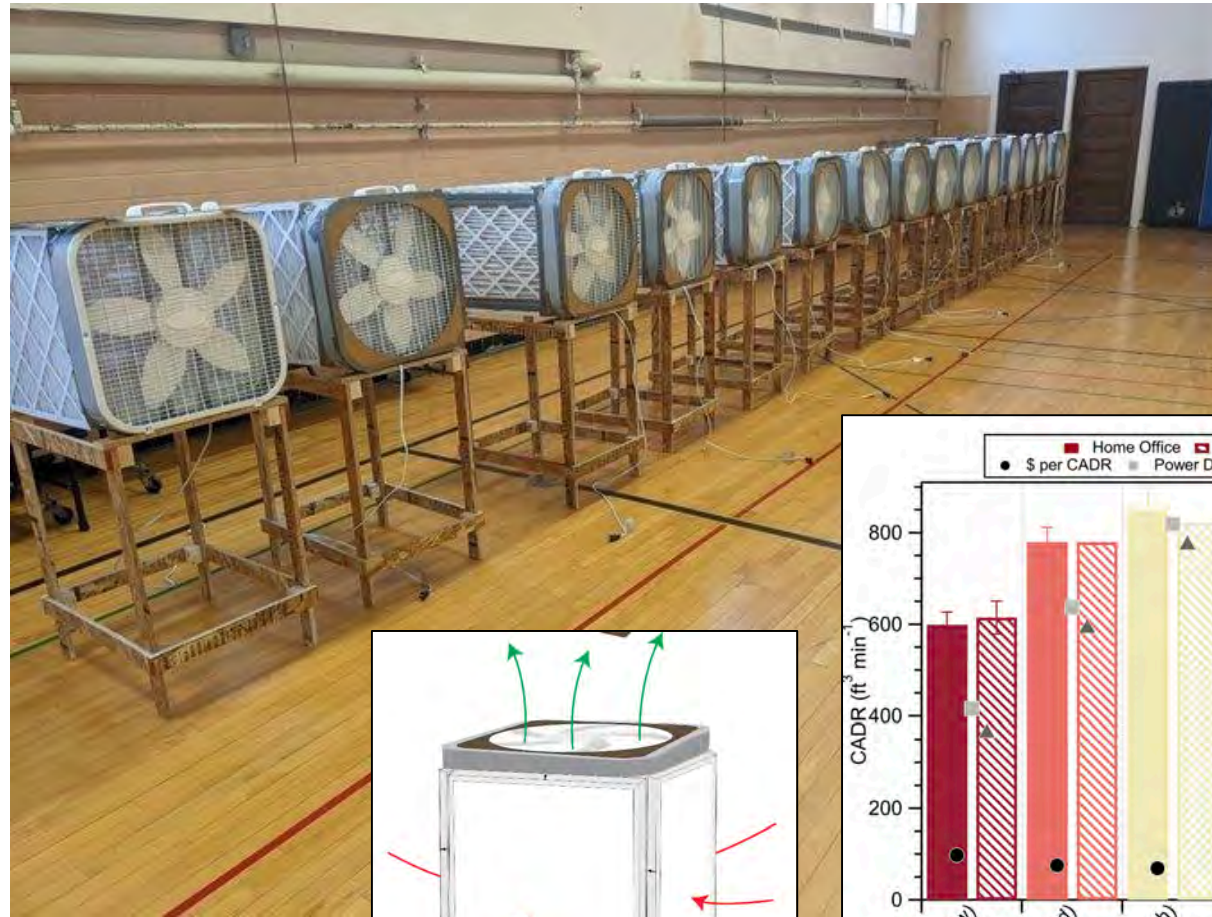
# Technical Objective

- ✓ Design prototype filtration system
- ✓ Test in the laboratory and refine design
- ✓ Fabricate for pilot deployment
- Refine design based on pilot results
- Fabricate for full field deployment

Nominal flow rates:  
2000-7000 CFM



# Inspiration: Corsi-Rosenthal Box Fan Filters



# Proposed Solution



Target: 4" MERV 13  
& activated carbon  
(particles + gases)

Wildfire event duration analysis suggests most events are less than 2 weeks

- Suggesting a relatively temporary, easily deployable solution is needed

<https://www.fire.ca.gov/incidents/2021/>

# Laboratory Testing @ IIT: Particle removal efficiency

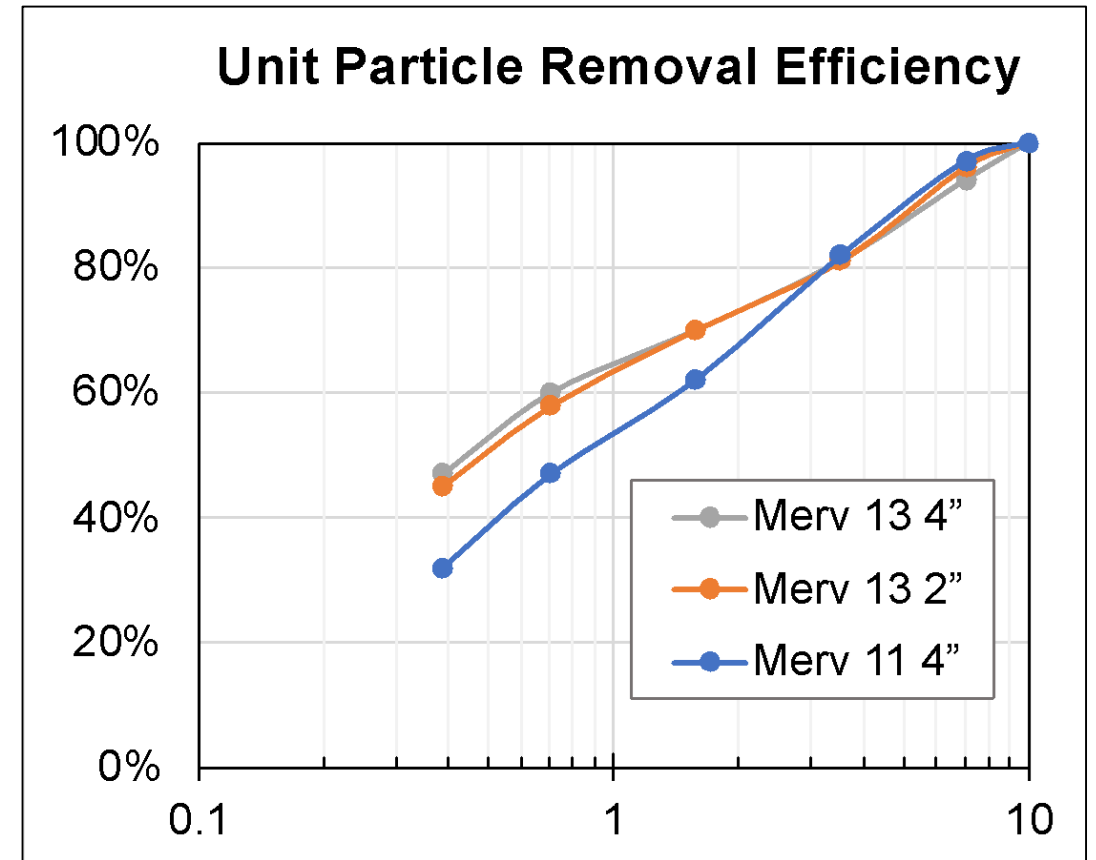
MetOne OPC (0.3-10  $\mu\text{m}$ , size-resolved)



Upstream



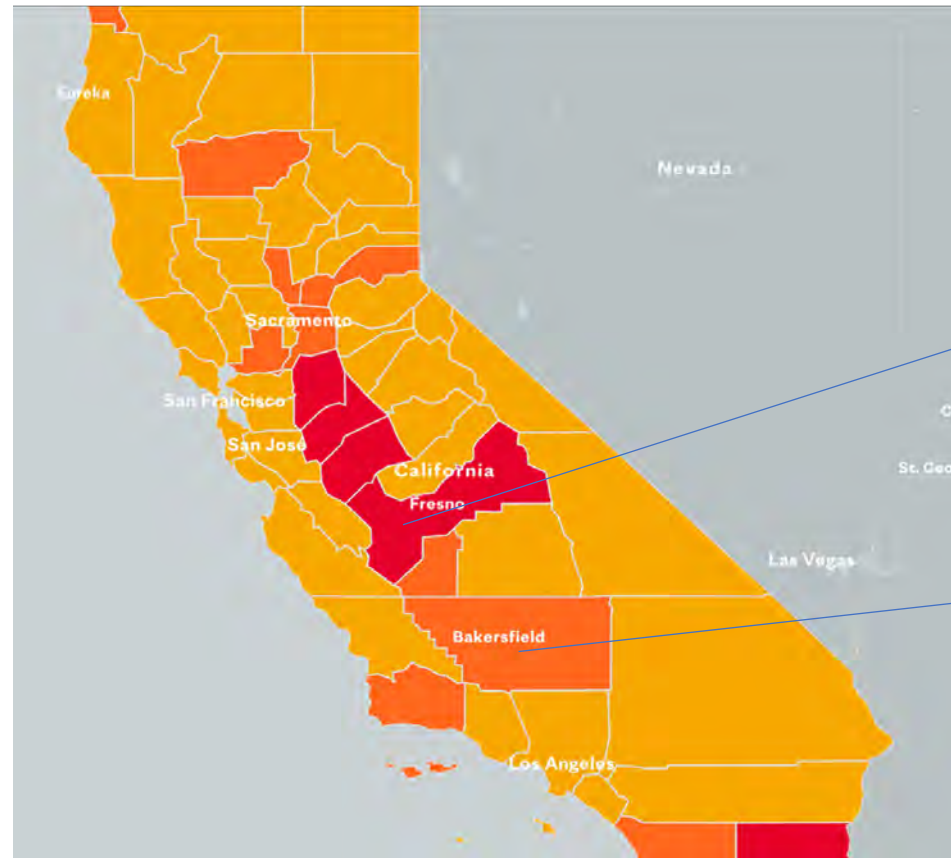
Downstream



Lab testing mirrors ASHRAE 52.2 MERV test results

$$Efficiency = 1 - \frac{C_{downstream}}{C_{upstream}}$$

Test the filters under field conditions focusing on homes of agricultural workers with respiratory symptoms



Coalinga  
Huron  
Avenal

Arvin  
Lamont  
Weedpatch



## Year 1: April – October 2022

- 2 community meetings in each area.
- 30 homes with swamp coolers recruited, half in Fresno, half in Kern.
- Consents, questionnaires and home surveys completed.
- Indoor PurpleAir PA-II monitors installed and maintained.
- Data loggers installed on swamp coolers.
- Outdoor monitors installed across each community.





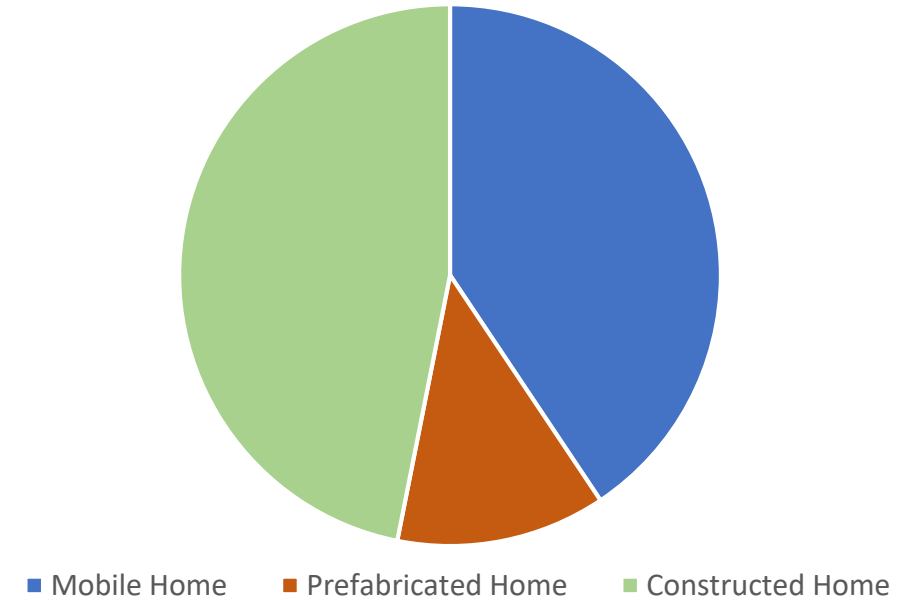
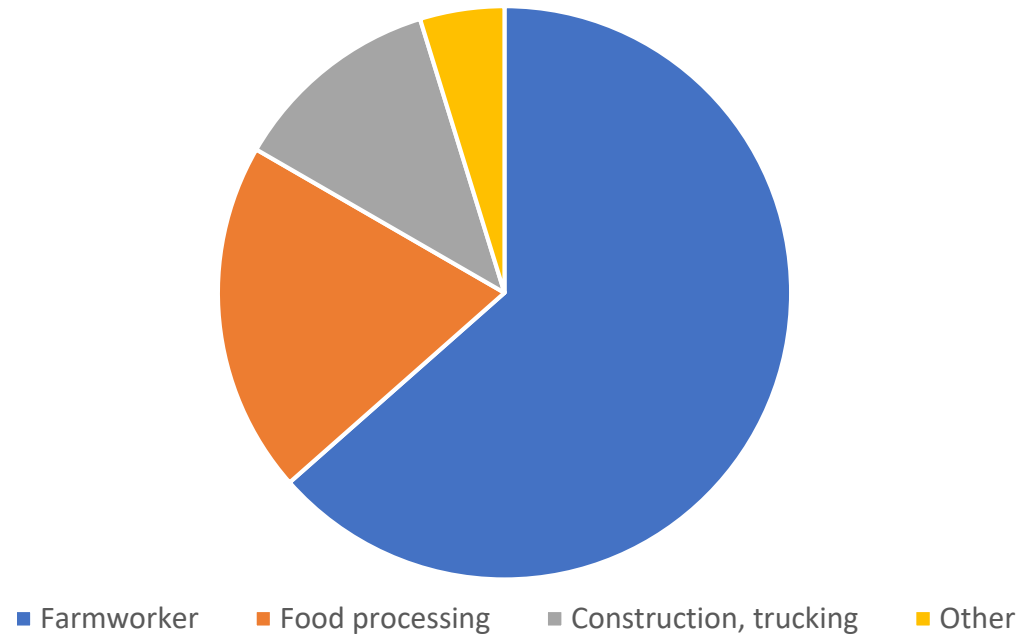


## Solutions Tested

- Filter on Evaporative Cooler (11 homes)
- Box Fan Filter (6 homes)
- Levoit Air Cleaner (7 homes)
- No intervention (2 homes)
- Attrition (4 homes)

# Study Participants: Year 1

- 100% completed consent and questionnaires in Spanish
- 78% were agricultural industry workers
- > Half live in a manufactured home
- Most homes < 1000 sq ft & over-crowded
- No HVAC systems



# FRESSCA - Mujeres

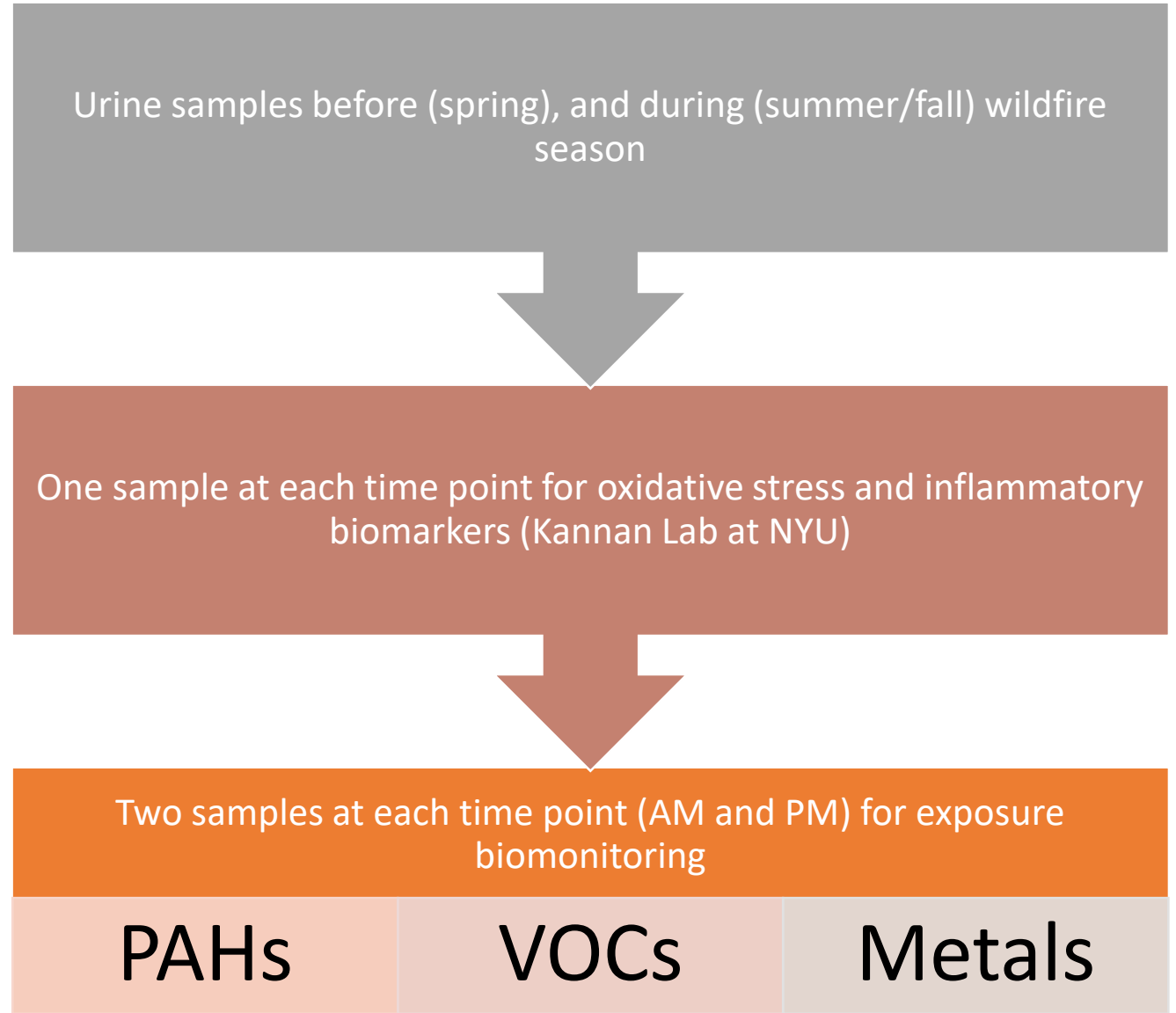
- Study potential health benefits of the FRESSCA interventions to reduce wildfire smoke exposure
- Focus on farmworker women living in the FRESSCA homes
- Look at biomarkers of potential breast cancer risk (oxidative stress, inflammation) before and during the wildfire season
- Collect marker of cumulative biological stress (telomere length)
- Engage with the women to tell their stories about smoke exposure and breast cancer concerns

# Plan for FRESSCA- Mujeres

- Recruit 58 participant homes with ECs, non-smokers
- Recruit women agricultural workers from each home
- Test EC filter vs. other intervention (box fan or Levoit air cleaner)
- Questionnaires:
  - Household and occupation
  - Respiratory symptoms and breast cancer risk
  - Baseline knowledge about wildfire smoke hazards and stress
- Continuous PurpleAir PA-II monitoring indoor/outdoor
- Intensive indoor/outdoor testing during a smoke event
  - VOCs, PAHs, metals, PM deposition and characterization



# Biomonitoring in Mujeres



## Questions for the SGP

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Recruitment: Farmworkers,  
agricultural industry, outdoor  
workers?

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Timing of sample collection:  
spring/summer-fall? Or pre/post  
filter installation?

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Questionnaires: What should we  
ask?

# FRESSCA/ Mujeres Study Team

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\*Pro bono





Thank you!

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