

AIR, CLIMATE & ENERGY



ORD Research Updates

Bryan Hubbell, National Program Director

US EPA/Office of Research and Development/Air, Climate, and Energy National Research Program

AAPCA Fall Business Meeting, August 30, 2024

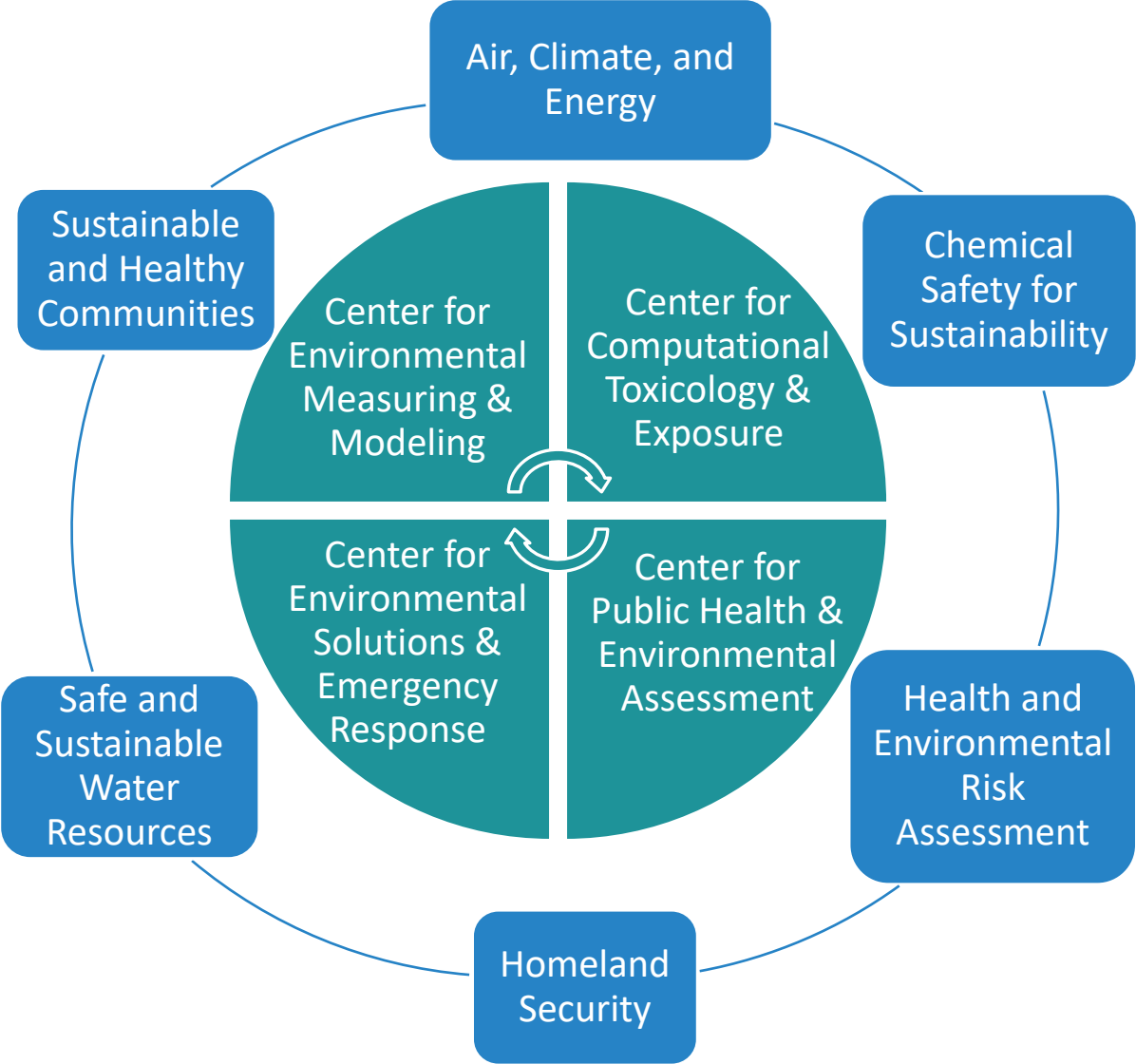
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 - ORD's Air, Climate, and Energy Research (ACE) Program
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 - Smoke from Wildland Urban Interface Fires
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- Science to Achieve Results (STAR) grants

US EPA's Office of Research and Development (ORD)

Mission:

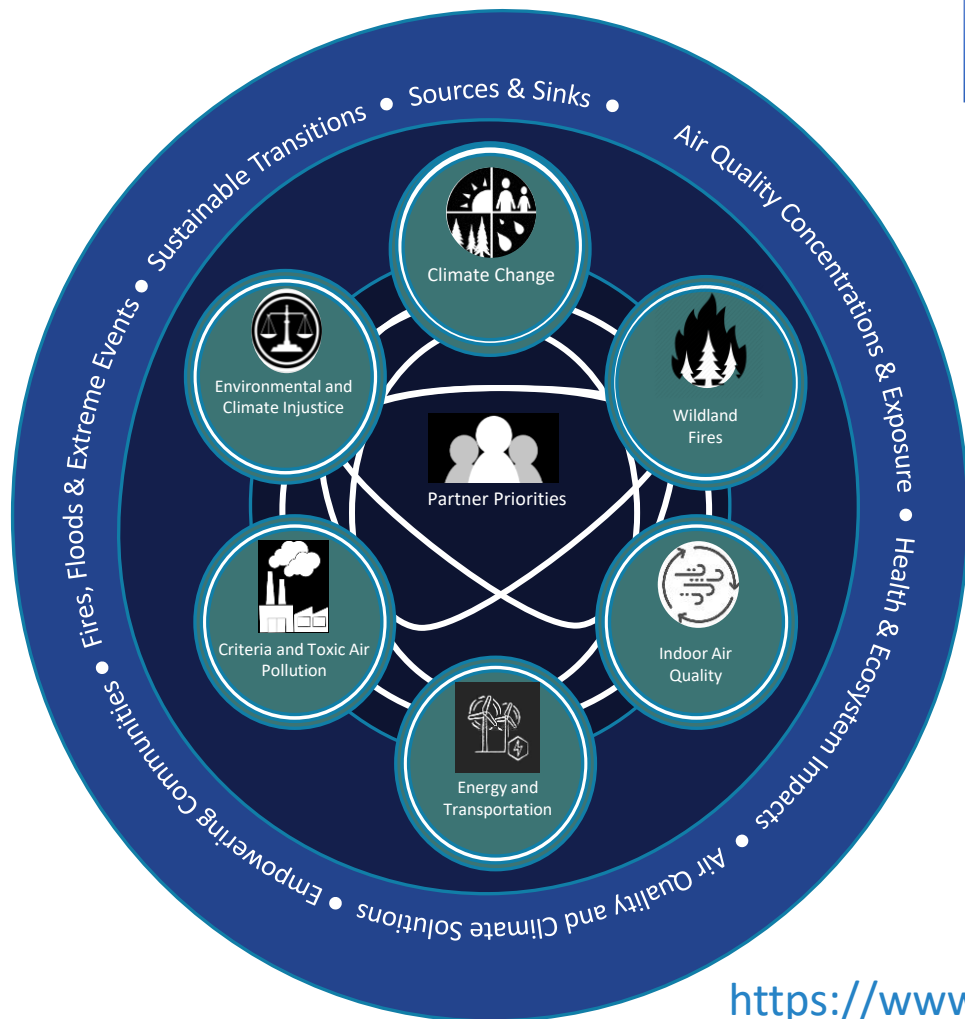
Provide leading-edge research to inform Agency decisions and support the emerging needs of EPA stakeholders, including state, tribal, and community partners.



Staff and researchers in 6 **National Research Programs** and 4 **Centers** are in labs and offices across the U.S.

Air, Climate, and Energy Research Program

A holistic vision to reduce environmental and health inequities AND respond to the impacts of climate change.



Topic 1: UNDERSTANDING Air Pollution and Climate Change and Their Impacts on Human Health and Ecosystems

Research Area 1:
Sources and Sinks of Air Pollution and Climate Forcers

Research Area 2:
Air Quality Concentrations and Exposure
Characterization: Measurements

Research Area 3:
Air Quality Concentrations and Exposure
Characterization: Modeling

Research Area 4:
Health Impacts of Air Pollution and Climate Change

Research Area 5:
Ecosystem Impacts of Air Pollution and Climate Change

Topic 2: RESPONDING to Risks and Impacts and Preparing for the Future

Research Area 6:
Scientific Support for Climate Change and Air Quality Policy Solutions

Research Area 7:
Empowering communities and individuals to improve public health

Research Area 8:
Responding to Risks of Fires, Floods, and Other Extreme Events

Research Area 9:
Transitions to a Sustainable Future

<https://www.epa.gov/research/strategic-research-action-plans-fiscal-years-2023-2026#ACE>

Air Quality Monitoring

- Air Monitoring Approaches for VOC Emissions
- PFAS Measurement Methods and Model Updates
- EtO Measurement Methods Updates

Monitoring Approaches for VOC Emissions

Next Generation Emissions Measurements (NGEM)



Sensor Pods (SPods)

- Monitor fuel storage terminal emissions
- In-plant leak detection analysis
- Fenceline/near-source VOC concerns



SPod sensors can help identify unknown emissions, indicate source direction, speciate VOC plumes (with triggered cans), and inform decision-making on investigations and/or monitoring.

Credit: Jake Carpenter, EPA R4



Odor Explore

- Mobile app - helps the public capture and report detailed information about odors
- Developed in partnership with Louisville Metro Air Pollution Control District (APCD)

 [NGEM Emission Measurements: Helping to Improve Air Quality and Source Understanding](#) - October 17, 2023

Presenters: Eben Thoma & Rachelle Duvall

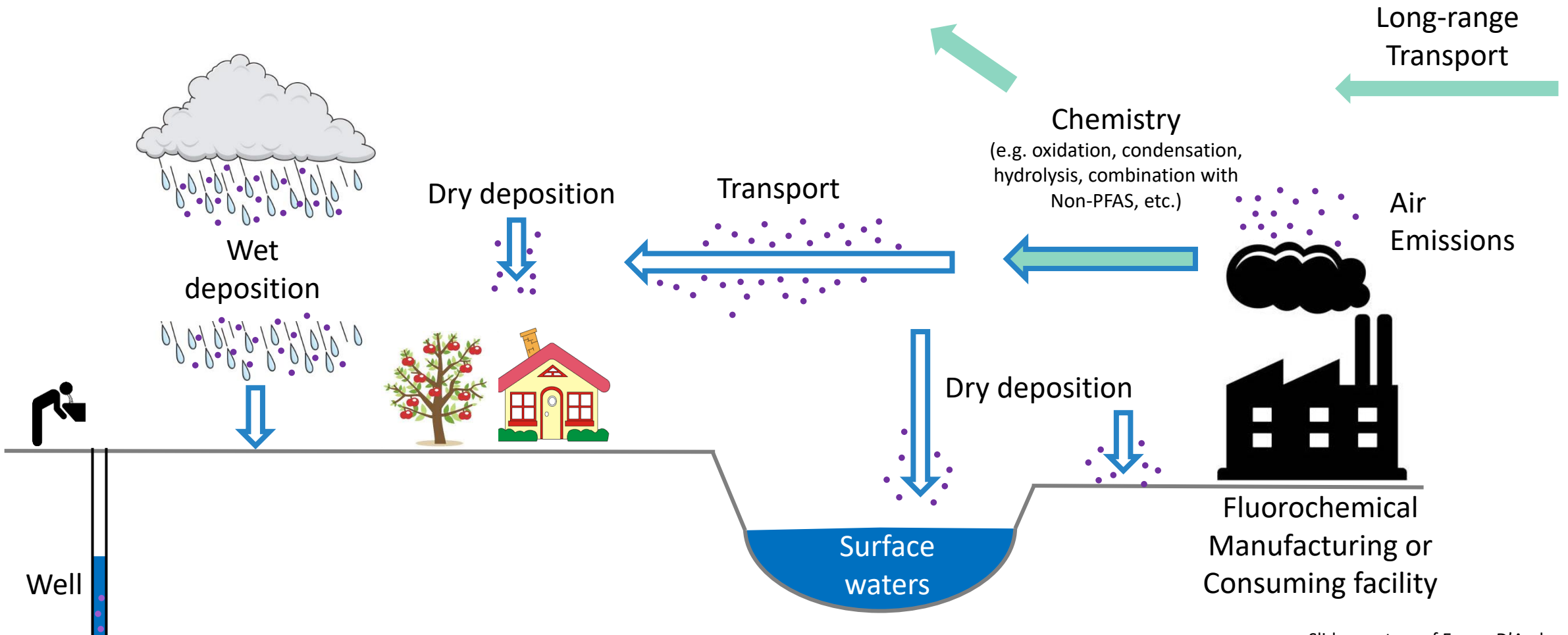
 [Sensor Pods for Volatile Organic Compound Fenceline Monitoring and Data Analysis](#) - December 1, 2022

Presenters: Eben Thoma & Megan MacDonald

[New Air Monitoring Technology to Understand Leaks and Irregular Emissions](#) - Science Matters, October 11, 2022

PFAS in Air

Research on Per- and Polyfluoroalkyl Substances (PFAS)



PFAS Measurement updates

- Canister technique for targeted measurements of PFAS
- [OTM-50: Sampling and analysis of volatile fluorinated compounds from stationary sources using passivated stainless-steel canisters](#)
 - Released January 2024.
 - Targeted analysis of multiple compounds and products of incomplete combustion (PICs)
- [OTM-45: Measurement of Selected Per- and Polyfluorinated Alkyl Substances from Stationary Sources](#)
- Field studies
 - Measurement of PFAS at two industrial facilities (a sewage sludge incinerator (SSI) and a pilot-scale aqueous film forming foam (AFFF) thermal treatment facility)

PFAS Modeling updates

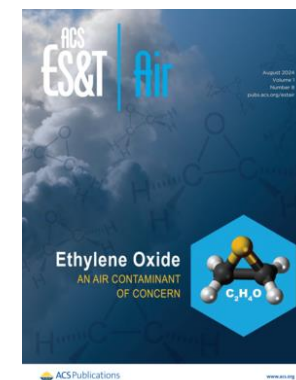
- [Predictions of PFAS regional-scale atmospheric deposition and ambient air exposure](#) - December 2023
-  [PFAS and Emerging Contaminant Technology Transfer to States and Tribes](#) - October 18, 2023
-  [EPA PFAS Strategic Roadmap: Research Tools and Resources](#) - August 17, 2022
-  [Modeling PFAS Air Emissions, Chemistry, and Deposition](#) - May 18, 2021
-  [Can we destroy deadly "forever chemicals"?](#) July 2024

Ethylene Oxide (EtO)

Hazardous Air Pollutants: Ethylene Oxide (EtO)

Ambient and Source Measurement

- ES&T Perspective: Ethylene Oxide: An Air Contaminant of Concern – May 30, 2024
- Optimized Approach for Measuring Ethylene Oxide in Mobile Source Exhaust – May 28, 2024
- Assessment of chemical facility ethylene oxide emissions using mobile and multipoint monitoring - April 2023
- Verona EtO Air Monitoring Study (interim public results, July 19, 2023)
 - Phase 1: 4-month field study in Verona, MO (October 5, 2022 - January 30, 2023)
 - Phase 2: starting soon at one of the Phase 1 sites



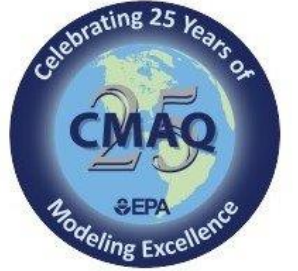
Regional Research

- Innovative measurement technology for ambient EtO quantification near facilities in overburdened communities.
 - EPA Region 2: Puerto Rico near a sterilizer facility (end Aug 2024)
 - EPA Region 5: Minnesota, Anoka County Airport Air Monitoring Site (NCore, PAMS, SLAMS) (complete)
 - EPA Region 7: Kansas City, KS near a chemical facility

Air Quality Modeling

- CMAQ
- EQUATES
- GLIMPSE Energy System Model

Air Quality Modeling



The Community Multiscale Air Quality Modeling System (CMAQ)

- Tool for translating fundamental atmospheric science principles to policy scenarios
- Release of CMAQ version 5.5 – Fall 2024

EQUATES: EPA's Air QUALity Time Series Project

- Unified set of modeling data: Meteorology, emissions, air quality and pollutant deposition
- Spans the years 2002 through 2019
- Consistent input data and methods across all years is useful to examine trends across years, states and sectors

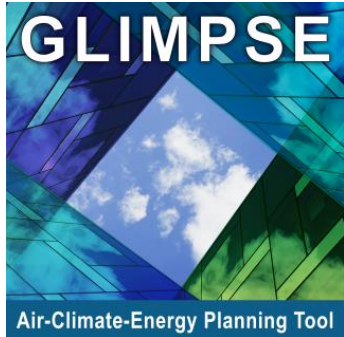


[What Can We Learn From a Consistent 18-Year Data Set?](#) September 20, 2022

Presenters: Kristen Foley, EPA ORD and Gregory Beachley, EPA OAP

Modeling to Meet Air Quality, Climate, and Energy Objectives

- Supports energy system modeling at the national, regional and state level.
 - Helps EPA program offices, states, researchers, and others with long-term environmental, climate, and energy planning.
 - Version 1.0 was released to the public in June 2023.
- Used in developing two Phase 1 Priority Climate Action Plans for Georgia and Tennessee
- Will be used by other states to develop Phase 2 Comprehensive Climate Action Plans to:
 - Estimate a state's GHG inventory and project that inventory into the future.
 - Explore the impact of specific GHG control measures, estimate the associated air quality and health co-benefits, and assess these co-benefits in the context of environmental justice.



GLIMPSE

- GLIMPSE training will be offered at EPA's CPRG Planning Grant Workshop:
 - Minneapolis (September 4-6, 2024)
 - Workshop for planning grantees with a focus on development of the Comprehensive Climate Action Plan.



 [Tools for Helping State and Municipal Decision Makers Make Air, Quality, and Climate Objectives: GLIMPSE and COMET](#) - August 15, 2023
Presenters: Dan Loughlin and Ozge Kaplan, EPA Office of Research and Development

Wildland Fire Emissions

- Smoke from Wildland Fires
- Advancements in Air Sensor Technology
- Air Sensor Tools and Resources
- Indoor Reductions of Smoke Exposures

Smoke from Wildland Fires



Prescribed Burning and Smoke Management Planning - May 15, 2024

Presenter: Bob McKane (EPA ORD)



Beyond PM_{2.5}: The Other Effects of Wildfires on Air and Water Quality - March 26, 2024

Presenters: Amara Holder and Steve LeDuc (EPA ORD)

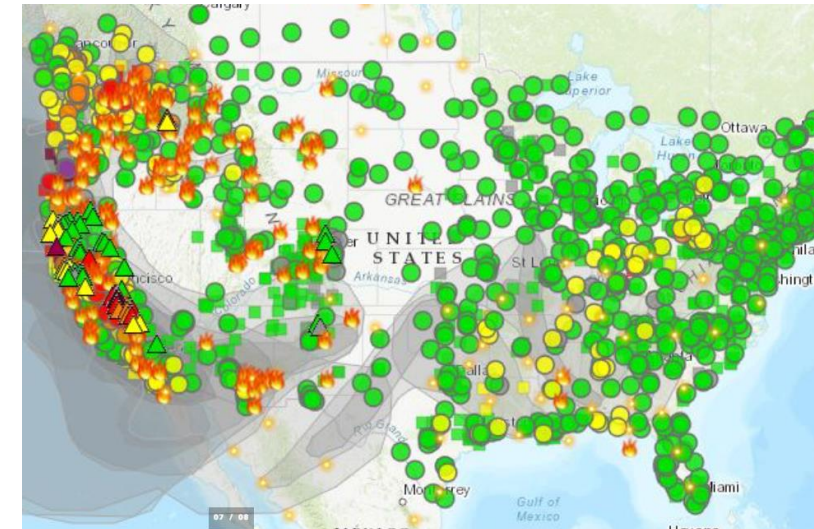


Emissions from Combustion of Materials in the Urban Environment

- **Hazardous air pollutant emissions estimates from wildfires in the wildland urban interface**
(i.e., burning structures and vehicles)
- **Ambient Monitoring and the Chemistry of Urban Interface Fires**

Crowdsourced Ambient Air Quality Data on the **AirNow Fire and Smoke Map**

- Crowdsourced information from lower-cost PurpleAir sensors + existing regulatory data.
- **Development and Application of a United States wide correction for PM_{2.5} data collected with the PurpleAir sensor**



AirNow Fire and Smoke Map: Extension of the US-Wide Correction for PurpleAir PM_{2.5}

Sensors - May 19, 2021



Presenters: Andrea Clements, Amara Holder, and Karoline Barkjohn, EPA ORD; Ron Evans, EPA OAR; and Sim Larkin, US Forest Service

Advancements in Air Sensor Technology

Vehicle Add-On Mobile Monitoring System (VAMMS)

- The VAMMS pairs GPS location with real-time ambient air quality measurements of PM_{2.5} in smoke during a wildfire.
- [Performance of Vehicle Add-on Mobile Monitoring System PM_{2.5} measurements during wildland fire episodes.](#)



Sensor Loan Program



The Wildfire Smoke Air Monitoring Response Technology ([WSMART](#)) program provides supplemental monitoring technology.

- [Air Sensor Loan Program](#) for state, local, and tribal air agencies affected by wildfire smoke.
- Includes VAMMS, PurpleAir, and a multipollutant sensor system measuring CO, tVOCs, and PM_{2.5}



PurpleAir
PM_{2.5}
sensor



Vehicle Add-on
Mobile Monitoring
System
(VAMMS)
PM_{2.5}

Air Sensor Tools and Resources

Air Sensor Guidebook


The [Guidebook](#) can help individuals, communities, environmental agencies, and others in planning and collecting air quality measurements using air sensors.

 [The Enhanced Air Sensor Guidebook](#) - April 26, 2023
Presenters: Andrea Clements & Rachelle Duvall, EPA ORD

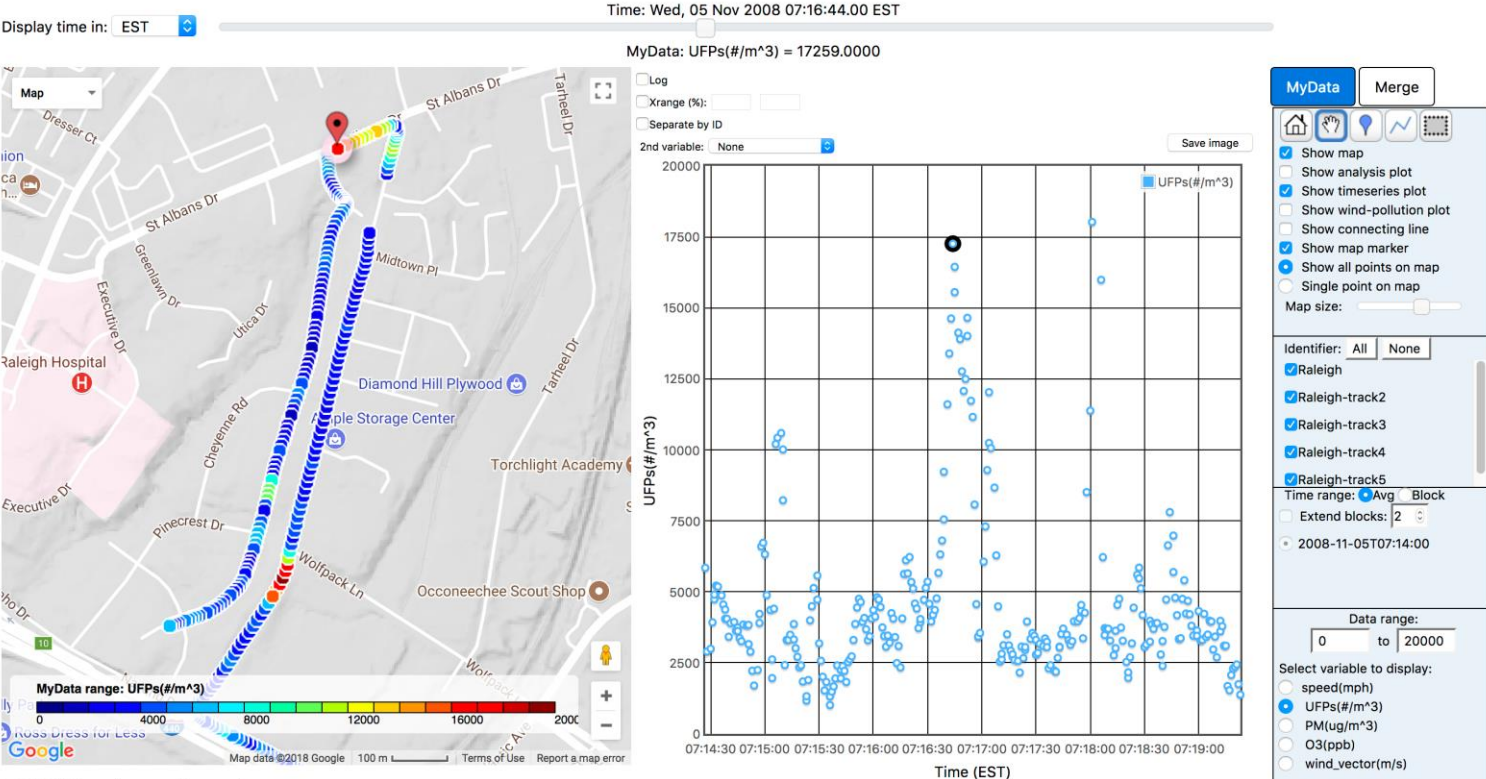


REal Time Geospatial Data Viewer (RETIGO)

[RETIGO](#) is a free, web-based tool that can be used to explore environmental data collected either stationary or in motion (e.g., a VAMMS, or air quality sensors added to a bike).

 [Web-Based Data Visualization of Air Sensor Data with RETIGO](#) - June 4, 2024
Presenter: Andrea Clements, EPA ORD

[EPA Scientists Update REal Time Geospatial Data Viewer \(RETIGO\) Web Tool](#) - Science Matters, August 7, 2024



Indoor Reductions of Smoke Exposures: WF-ASPIRE*

ASHRAE's Planning Framework for Protecting Commercial Occupants from Smoke During Wildfire Events

- Recommends building measures to minimize occupant health impacts from wildfire and prescribed fire smoke events.
- Second public review comment period closed July 29. Goal to publish the guidelines later this year.

Cleaner Indoor Air During Wildfires Challenge

➤ Phase 2 winners



The Cocoon



Metalmark Clean Air Device



Cleaner Indoor Air During Wildfires Challenge:
Phase II Winners - February 20, 2024
Moderator: Sarah Coefield, EPA ORD



Field Study Results (Hoopa Valley)

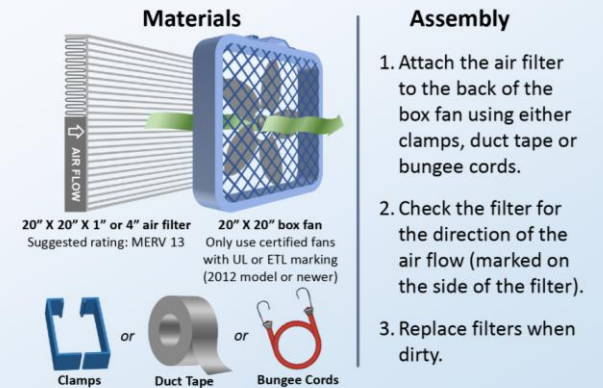
- Self-reported health impacts of do-it-yourself air cleaner use in a smoke-impacted community
- Usage and impact of a do-it-yourself air cleaner on residential PM_{2.5} in a smoke-impacted community

Do-It-Yourself Air Cleaners: Making Cleaner Air More Accessible

Science Matters, September 6, 2023

* Wildfire Study to Advance Science Partnerships for Indoor Reductions of Smoke Exposures

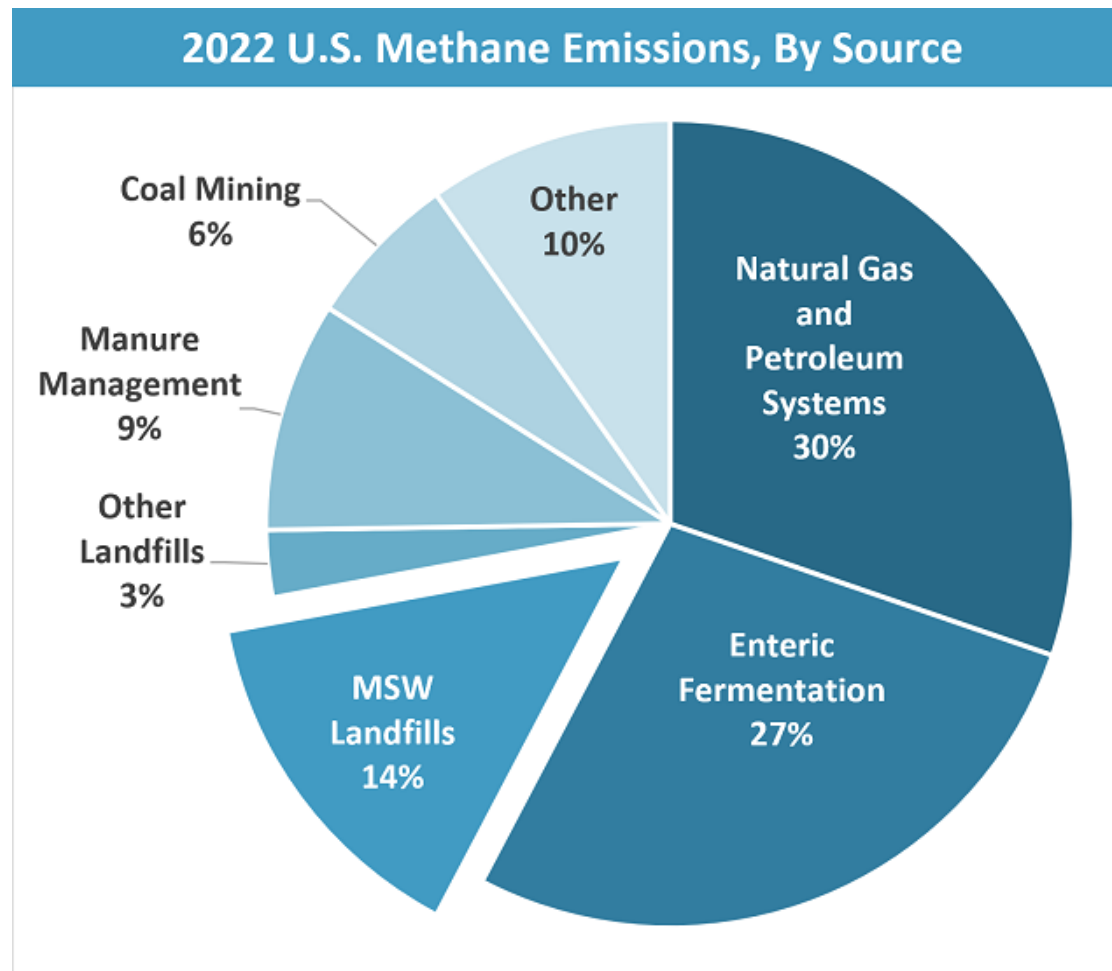
DIY Air Cleaner to Reduce Wildfire Smoke Indoors: Basic Design



Learn about box fan safety tips:
<https://www.epa.gov/air-research/research-diy-air-cleaners-reduce-wildfire-smoke-indoors#FAQ>

Methane Emissions

- Landfills
- Oil and Gas



Detecting Methane Emissions

Landfills

- Methane emissions from landfills (identifying super emitters)
 - ORD researchers worked with Carbon Mapper to evaluate Optical Remote Sensing (ORS) for about 20% of U.S. landfills (across 18 states)
 - In some air basins, methane from landfills > methane from oil and gas operations
 - [Quantifying methane emissions from United States landfills | Science](#)



Oil and Gas Operations

- Development and testing of methane sensor
 - ORD researchers worked with SENSIT to evaluate a Fixed Methane Detector (FMD) sensor system for remote monitoring of methane for oil and gas
 - Builds upon previous technologies including the open-source EPA SPod fenceline sensor design
 - Continuously collects methane and meteorological data and transmits via a cellular network
 - Presented at Air & Waste Management Association, Air Quality Measurement Methods and Technology Conference, Durham, NC, November 14 - 16, 2023



Extramural Research - grants



- Air Quality Information: **Making Sense of Air Pollution Data** to Inform Decisions in Underserved Communities Overburdened by Air Pollution Exposures
- Understanding and Control of Municipal Solid Waste **Landfill Air Emissions**
- Drivers and Environmental Impacts of **Energy Transitions** in Underserved Communities
- Measurement and Monitoring Methods for **Air Toxics and Contaminants of Emerging Concern** in the Atmosphere
- Interventions and Communication Strategies to Reduce Health Risks of **Wildland Fire Smoke Exposures**

US EPA Science to Achieve Results (STAR) grants



Air Quality Information: Making Sense of Air Pollution Data to Inform Decisions in Underserved Communities Overburdened by Air Pollution Exposures

- NOFO closed June 26, 2024. [More information](#)



Understanding and Control of Municipal Solid Waste Landfill Air Emissions

- November 2023 - EPA awarded \$4.6 million in grant funding to five institutions for research to quantify and mitigate emissions from municipal solid waste landfills. [More information](#)



Drivers and Environmental Impacts of Energy Transitions in Underserved Communities

- June 2023 - EPA awarded \$11 million in grant funding to eleven institutions for research to address the drivers and environmental impacts of energy transitions in underserved and Tribal communities. [More information](#)



Measurement and Monitoring Methods for Air Toxics and Contaminants of Emerging Concern in the Atmosphere

- May 2022 - EPA awarded seven grants to support research to advance measurement and monitoring methods for air toxics and contaminants of emerging concern in the atmosphere. [More information](#)



Interventions and Communication Strategies to Reduce Health Risks of Wildland Fire Smoke Exposures

- September 2021 - EPA awarded over \$9 million in funding to twelve institutions for research that will address behavioral, technical and practical aspects of interventions and communication strategies to reduce exposures and health risks of wildland fire smoke. [More information](#)





“Landfill Emissions” Grants and Study Locations:

Integrating Measurements Across Platforms to Feasibly Assess Emissions and Mitigation of Methane and VOCs from Landfills

Mike Hannigan, University of Colorado Boulder



Analysis of Continuous Monitoring Data with Inverse Atmospheric Models to Improve Landfill Gas Emissions Data and Elucidate Drivers of Emissions

Jamie Schauer, University of Wisconsin



Next-Generation Landfill Monitoring: A Multi-Scale Approach to Measuring Emissions for Evaluating and Financing Interventions

Dimitrios Zekkos, University of California Berkeley



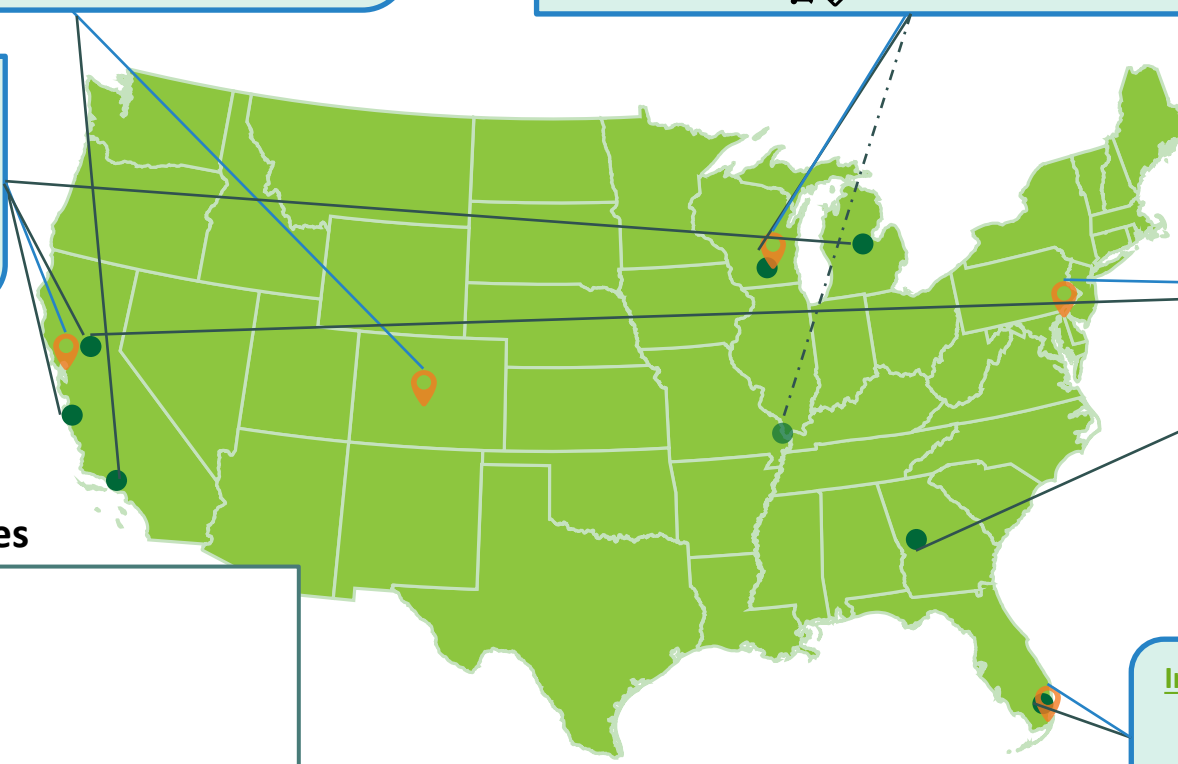
Evaluation and Control of Emissions from MSW Landfills: Direct Measurement and Modeling

Paul Imhoff, University of Delaware



Integrating Multi-Source Data for Landfill Methane Emission Quantification

Jiayu Li, University of Miami



Map Legend

- Primary Institution
- Landfill Location

Measurement Approaches

- | | |
|--------------|-----------------------------------|
| Satellite | Aircraft |
| Drone | Flux tower |
| Open-path | Mobile car |
| Rover | Surface Emission Monitoring (SEM) |
| Flux Chamber | Stationary sensors or monitors |

For additional information: https://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/recipients.display/rfa_id/701



Selected “Drivers” and “Interventions” Grants

Study locations that overlap with AAPCA State and Local members :

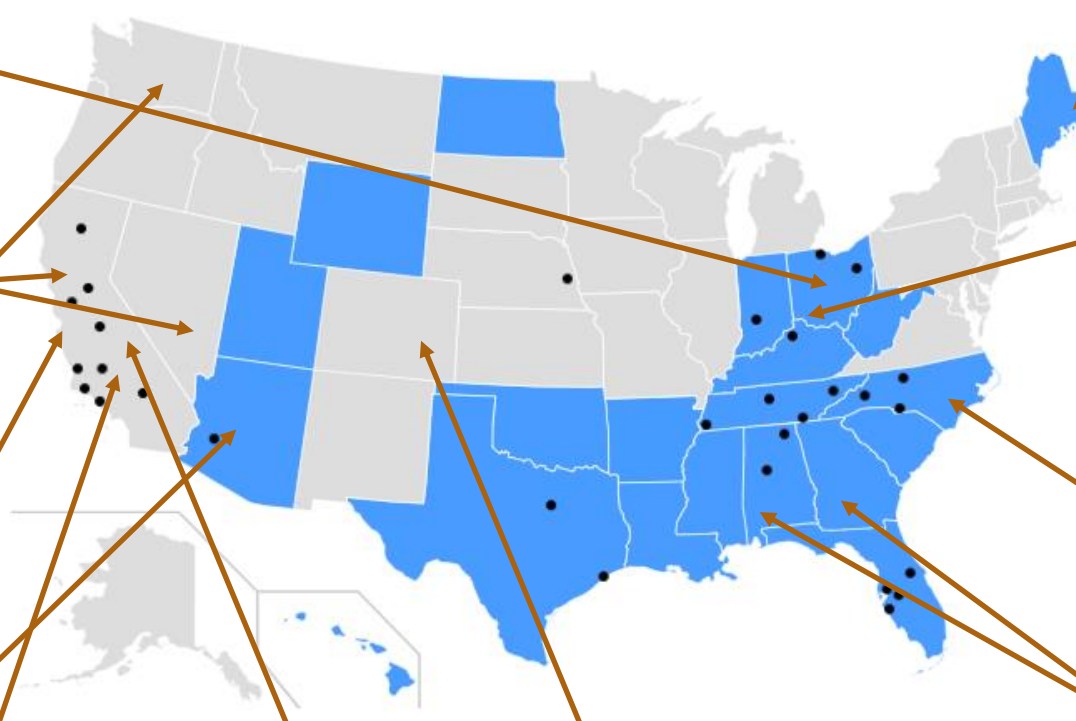
FLEETS for All: Facilitating Local Energy and Transportation Services for All
Jeff Bielicki, Ohio State
Urban & rural underserved communities in Columbus Metro area

Environmental Justice Impacts Across the Life Cycle of Energy Storage
Alida Cantor, Portland State U
Rural & tribal communities near energy storage infrastructure & activities in CA, NV, and WA

Community Health and Air Quality Implications of Refinery Retrofits and Retirements (CHAIRS)
Lara Cushing, U California Los Angeles
*Community Partner: **Asian Pacific Environmental Network**
Communities near oil refineries in the San Fran. Bay area

Environmental Justice Implications of Public Transit Electrification and Changing Generation Portfolios in AZ
Danae Hernandez-Cortes, Arizona State U
*Community Partners: **Unlimited Potential**
Maricopa County, AZ

Filtration for Respiratory Exposure to wildfire Smoke from Swamp Cooler Air (FRESSCA)
Gina Solomon, Public Health Institute
Fresno and Kern counties, CA



The Role of State Networks in Advancing Community-Initiated and -Engaged Sustainable Energy Action in Underserved Communities
Sharon Klein, U Maine
*Tribal Partner: **Penobscot Nation**
Indigenous, rural, & low-income communities in Maine

Evaluating the Environmental, Behavioral, and Financial Benefits of Electrification and Energy Efficiency for Underserved Communities
Ryan Mooney-Bullock, Green Umbrella
*Community Partner: **Over-the-Rhine Community Housing**
Low-income multifamily-unit residents in Cincinnati

Renewable ENERGY, Environmental justice, and public Wellbeing (RENEW) - Evaluating biogas transformation in Eastern NC
Crystal Lee Pow Jackson, Research Triangle Institute
Community Partner: **Environmental Justice Community Action Network**
Communities in Sampson & Duplin Counties, NC

Participatory Design of Effective Risk Communication about Wildfire Smoke for Hard-to-Reach Populations
Linda Neuhauser, UC Berkeley
CA; Tachi Yokut Tribe, Santa Rosa Rancheria

Assessing the Transport of Wildfire-Generated Particulate Matter Into Homes and Developing Practical Interventions to Reduce Human Exposure (WildPM)
Marina Vance, CU Boulder
CO or other parts of western U.S.

Integrated Communication and Intervention Strategies to Reduce Exposure to Prescribed Wildland Fire Emissions in Schools, Schoolchildren and Communities
Ted Russell, Georgia Tech
Southern GA and southern AL

Legend:

- Drivers and Environmental Impacts of Energy Transitions in Underserved Communities - \$11 million awarded to eleven institutions
- Address Interventions and Communication Strategies to Reduce Health Risks of Wildland Fire Smoke Exposures - \$7 million awarded to ten institutions

Contact

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<https://www.epa.gov/aboutepa/about-air-climate-and-energy-research-program>

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**Air, Climate, & Energy
Research Webinar
Series**
(Quarterly)



**Air Research
News**
(Less than once
per month)



**Wildland Fire
Science News**
(Less than once
per month)



**Air Sensor Community
Science News**
(Less than once
per month)



**Science Matters
Newsletter**
(Biweekly)

