Air, Climate, and Energy Research Updates

NACAA Air Toxics Committee, October 5, 2023

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US EPA, Office of Research and Development

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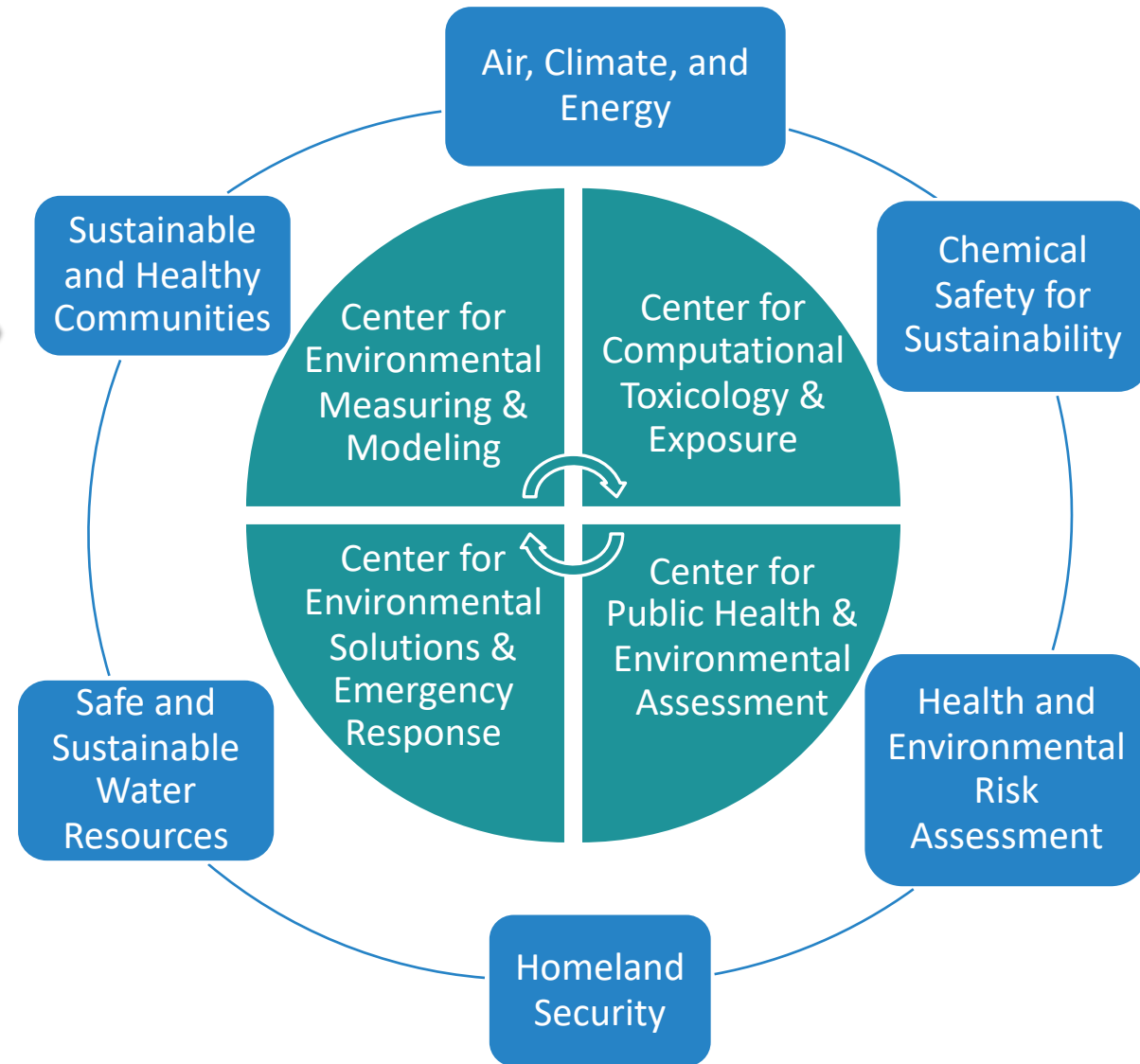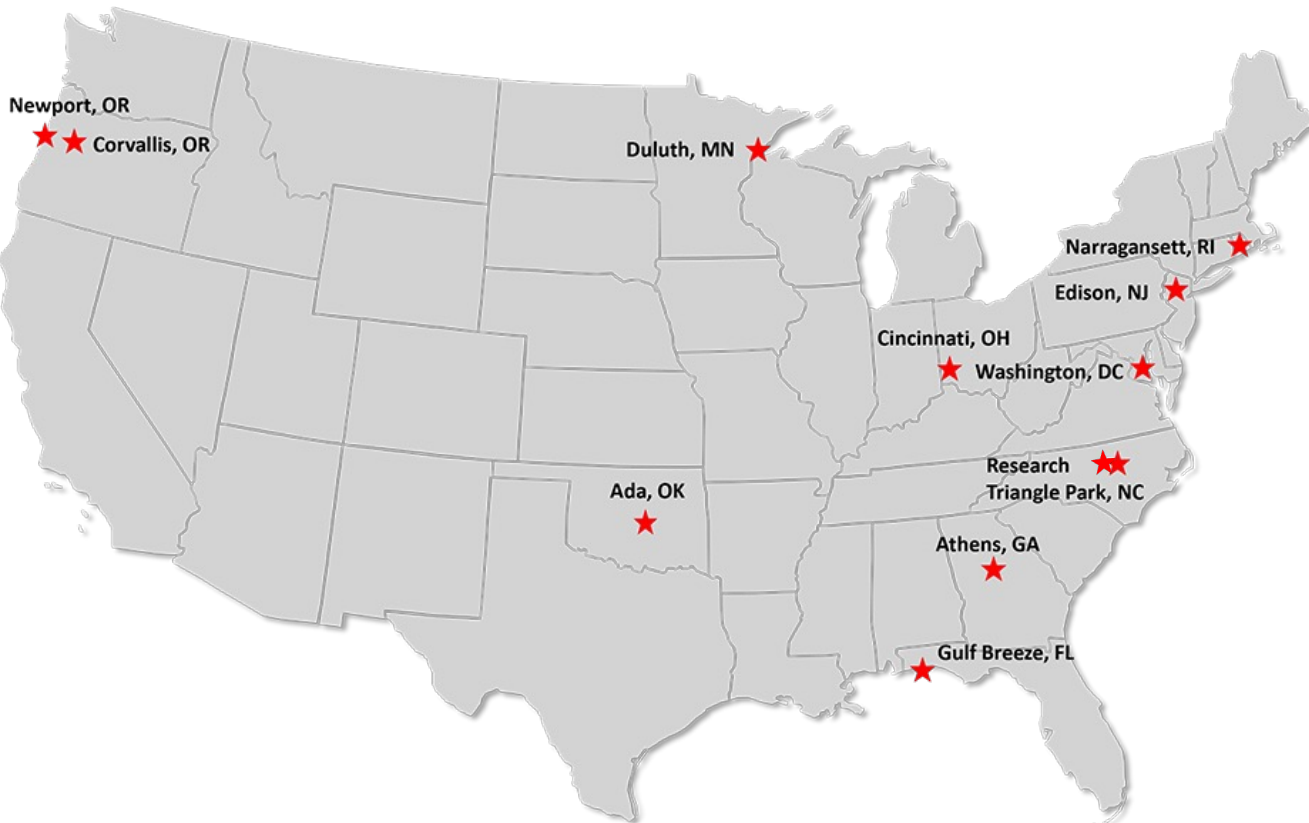
Staff and researchers in 6 National Research Programs and 4 Centers are in labs and offices across the U.S.

Air, Climate, and Energy Research Program

A holistic vision to reduce environmental and health inequities AND respond to the impacts of climate change.
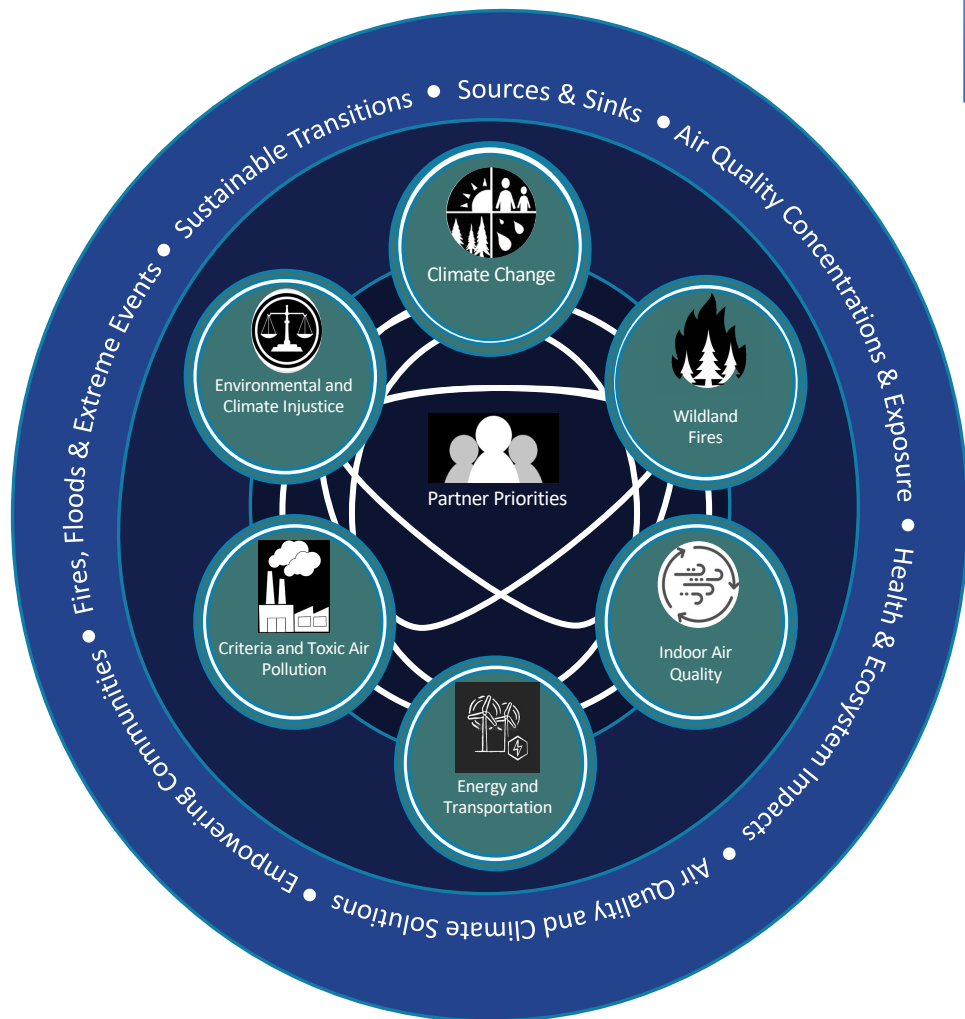
Topic 1: UNDERSTANDING Air Pollution and Climate Change and Their Impacts on Human Health and Ecosystems

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

Monitoring Approaches for VOC Emissions

- Measure emissions at fugitive and area sources and for fenceline monitoring.

- Understand air emissions from storage tanks.

- Understand air emissions from landfills.

Sensor Pods (SPods)

➤ SPods can automatically trigger a canister grab sample

➤ EPA's open source version is commercially available

➤ Monitor fuel storage terminal emissions

  ➤ Research near bulk terminals in Greensboro, NC

➤ In-plant leak detection analysis

  ➤ Research in Corpus Christi, TX

➤ Fenceline/near-source VOC concerns

  ➤ Study in Rubbertown (industrial area of Louisville, Kentucky)

  ➤ EPA Region 4 Program to loan commercial SPods to state, local, or tribal partners

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

Upcoming: *NGEM Emission Measurements: Helping to Improve Air Quality and Source Understanding*

ACE Research Webinar October 17, 2023
Presenters: Eben Thoma & Rachelle Duvall

Sensor Pods for Volatile Organic Compound Fenceline Monitoring and Data Analysis
Webinar, December 1, 2022
Presenters: Eben Thoma & Megan MacDonald

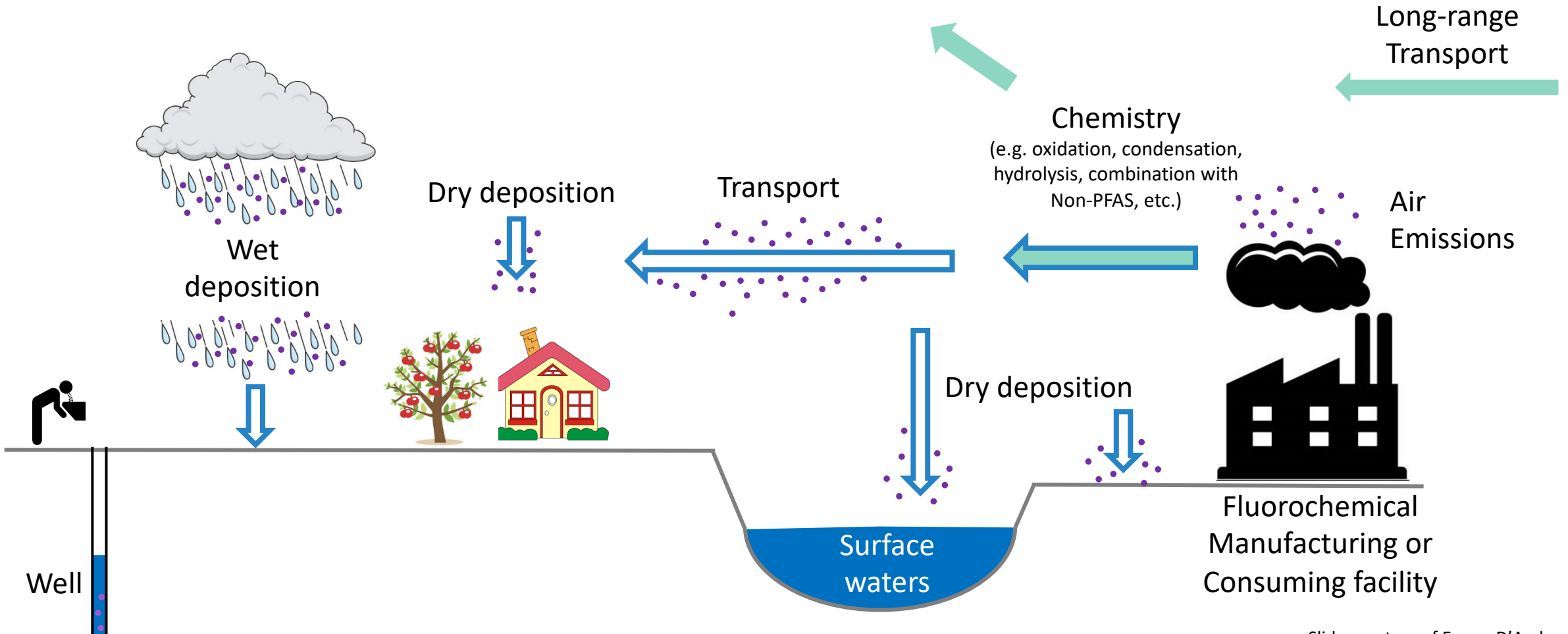New Air Monitoring Technology to Understand Leaks and Irregular Emissions - Science Matters, October 11, 2022

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)

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PFAS in Air

Research on Per- and Polyfluoroalkyl Substances (PFAS)

Long-range Transport

Chemistry
(e.g. oxidation, condensation, hydrolysis, combination with Non-PFAS, etc.)

Air Emissions

Dry deposition

Transport

Wet deposition

Dry deposition

Surface waters

Fluorochemical Manufacturing or Consuming facility

Well

Slide courtesy of Emma D'Ambro, US EPA

PFAS measurement methods and model updates

Method updates

- Modified TO-15A
  - Explore TO-15A based technique using canisters for targeted measurements of PFAS
- Field evaluations of OTM-45
  - Measurement of PFAS at two industrial facilities (a sewage sludge incinerator (SSI) and a pilot-scale aqueous film forming foam (AFFF) thermal treatment facility)
  - Other Test Method 45 (OTM-45) Measurement of Selected Per- and Polyfluorinated Alkyl Substances from Stationary Sources

Modeling updates

- Predictions of PFAS regional-scale atmospheric deposition and ambient air exposure December 2023
- Characterizing Air Emissions, Transport, and Deposition of PFAS from a Fluoropolymer Manufacturing Facility January 2021

Upcoming: *PFAS and Emerging Contaminant Technology Transfer to States and Tribes* - October 18
Presenters: Tim Buckley and Jon Sobus, EPA ORD
Register at https://www.epa.gov/research-states/epa-tools-and-resources-webinar-series

EPA PFAS Strategic Roadmap: Research Tools and Resources - August 17, 2022
Presenters: Alice Gilliland, Laura Carlson, Avanti Shirke, and Phillip Potter, EPA ORD

Modeling PFAS Air Emissions, Chemistry, and Deposition - May 18, 2021
Presenters: Emma D'Ambro and Ben Murphy, EPA ORD

Ethylene Oxide (EtO)

Hazardous Air Pollutants: Ethylene Oxide (EtO)

Measurement updates

➢ Ambient and Source measurement methods

    ➢ Method TO-15A

    ➢ Status of EtO Source Measurements presented at AWMA Meeting in December 2022

➢ Assessment of chemical facility ethylene oxide emissions using mobile and multipoint monitoring (Atmospheric Environment X, April 2023)

➢ Verona EtO Air Monitoring Study (interim public results, July 19, 2023)

    ➢ 4-month field study in Verona, MO (October 5, 2022 - January 30, 2023)

    ➢ 24-hour EtO canister samples at three sites near facility

        ➢ Site 1 was north of fenceline and downwind

        ➢ Sites 2 and 3 were in community and southwest of facility

Regional Research (active projects)

➢ Ambient ethylene oxide quantification in overburdened communities near facilities using innovative measurement technologies

    ➢ EPA Regions 2, 5, 7 with study locations in PR near a sterilizer facility, at an established air toxics monitoring site in R5, and in Kansas City, KS near a chemical facility.

    ➢ Complementary project to build capacity on methods to detect EtO at lower levels in the field.

6-ppd quinone

Emissions from Motor Vehicles via Brake and Tire Wear

➢ Understanding Airborne Emissions and Health Impacts of 6-ppd quinone from Tires
  ➢ Speciation of emissions including PM and other compounds, e.g., 6ppd-quinone, metals
➢ Evaluating Impacts on Pacific Northwest Salmonid populations

Regional Research (active projects)

➢ Understanding Airborne Emissions and Health Impacts of 6PPD from Tires
  ➢ EPA Region 3 with study locations in DC, VA, and NC.
  ➢ Complementary project to build capacity on methods to detect EtO at lower levels in the field.
  ➢ 2023 Pathfinder Innovation Project awards

Smoke from Fires

Emissions from Combustion of Materials in the Urban Environment

➢ Characterize Emissions from WUI Fires

  ➢ WUI = Wildland Urban Interface (i.e., burning structures and vehicles)

  ➢ Study will use both laboratory and field measurements.

  ➢ Compile emission factors for criteria and toxic air pollutants.

Air Sensor Resources

The Wildfire Smoke Air Monitoring Response Technology (**WSMART**) pilot

➢ **Air Sensor Loan Program** for state, local, and tribal air agencies affected by wildfire smoke.
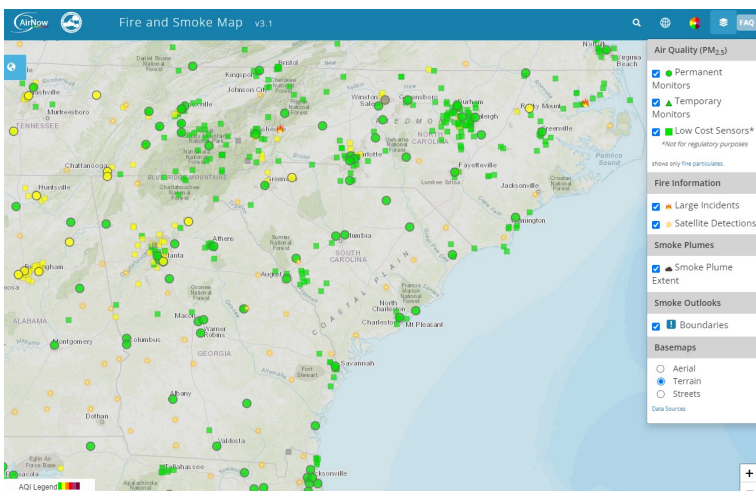

ThingyAQ PM$_{2.5}$, CO, VOC sensor

Vehicle Add-on Mobile Monitoring System (VAMMS) PM$_{2.5}$

PurpleAir PM$_{2.5}$ sensor

AirNow Fire and Smoke Map

➢ Correction factor for PurpleAir PM2.5 sensors

➢ Allows display of both regulatory monitor and sensor data.

AirNow Fire and Smoke Map: Extension of the US-Wide Correction for PurpleAir PM2.5 Sensors - May 19, 2021

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

Reducing Indoor Air Exposures

- Advance solutions-driven research

- Evaluate clean air spaces during smoke episodes

- Investigate effectiveness of air filtration systems to reduce PM2.5.

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.

➢ 45-day public review process for the draft guideline runs August 18 to October 2, 2023.

Cleaner Indoor Air During Wildfires Challenge Phase 2

➢ Phase 1 winners invited to submit prototypes for evaluation

➢ Judging is underway

Field studies

➢ Underway in Tulare County, CA with community partner Central California Environmental Justice Network (CCEJN) to evaluate DIY air cleaners in homes.

➢ Completed in Missoula, MT and Hoopa, CA with a focus on clean indoor air spaces in commercial and public buildings.

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

Interconnected components of WF-ASPIRE
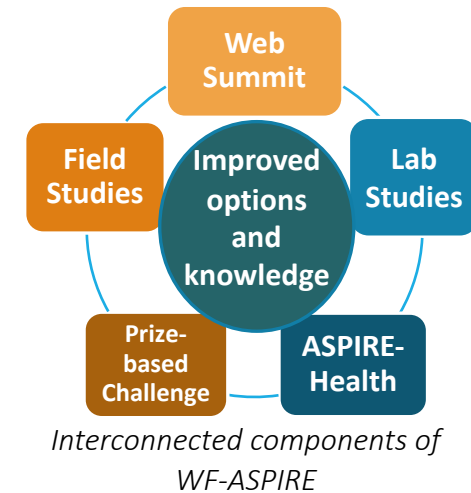
DIY Air Cleaner to Reduce Wildfire Smoke Indoors: Basic Design

Materials

20" X 20" X 1" or 4" air filter
Suggested rating: MERV 13

20" X 20" box fan
Only use certified fans with UL or ETL marking (2012 model or newer)

Clamps   or   Duct Tape   or   Bungee Cords

Assembly

1. Attach the air filter to the back of the box fan using either clamps, duct tape or bungee cords.

2. Check the filter for the direction of the air flow (marked on the side of the filter).

3. Replace filters when dirty.

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

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 5.4

➢ 3-part CMAQ 25th anniversary Science Matters series:

CMAQ: Celebrating 25 Years of Air Quality Modeling Excellence Science Matters, June 21, 2023

CMAQ: Demonstrating Skill Across Media and Around the World Science Matters, June 21, 2023

CMAQ: Tackling Emerging Concerns and Building for the Future Science Matters, June 21, 2023

AERMOD

➢ Dispersion model

➢ AERMOD and updates (December 2022)

➢ *Evaluation of AERMOD options for mobile source modeling*, presentation at RSL Modelers' Workshop, Kansas City, MO, June 27-29, 2023

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

US EPA Science to Achieve Results (STAR) grants

Drivers and Environmental Impacts of Energy Transitions in Underserved Communities

➢ 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

➢ 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

➢ 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

Coming soon: Recipients of Understanding and Control of Municipal Solid Waste Landfill Air Emissions

Contact

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