Federal Interagency Committee on Indoor Air Quality (CIAQ) Meeting Minutes

June 26, 2024

Moderator: Laureen Burton, U.S. Environmental Protection Agency (EPA)

Meeting Overview

- Welcome, Announcements and Introductions
- Federal CIAQ Member Agency Updates (Pages 2–27)

- Indoor Air Quality (IAQ) Area of Interest Presentation

  Air Pollutant Exposure Concentrations from Cooking a Meal with a Gas or Induction Cooktop and the Effectiveness of Two Recirculating Range Hoods with Filters

  Brett Singer, Ph.D., Senior Scientist, Lawrence Berkeley National Laboratory

  Jiayu Li, Ph.D., Postdoctoral Researcher, Center for the Built Environment, University of California, Berkeley

- Post-Meeting Updates and Announcements
  - The next CIAQ meeting will be held in October 2024.

U.S. Department of Energy (DOE)

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The Building Technologies Office

New Research Study

Commercial Kitchen Indoor Environmental Quality Field Study. https://indoor.lbl.gov/kitchen-study. The Lawrence Berkeley National Laboratory (LBNL), with support from Frontier Energy's Food Service Technology Center and the University of California at Berkeley's Center for the Built Environment, is conducting a study to gather data on thermal conditions and air quality at 20 commercial kitchens. It includes a free energy assessment and opportunities for kitchen staff to provide feedback.

LBNL completed 1-week-long monitoring (particulate and gas pollutants, thermal stress, one-time walkthrough assessment of appliances, ventilation hood performance assessment) at two restaurants in Lafayette, CA. Participating restaurants have given generally positive feedback on the monitoring so far. LBNL is actively recruiting new locations for measurements over the summer. LBNL will present preliminary results at the Indoor Air 2024 conference in July.

New Initiative

The Building Technologies Office is participating in the White House–sponsored Joint Capabilities Plan (JCP) called *National Biodefense Strategy* and *Implementation Plan for Countering Biological Threats, Enhancing Pandemic Preparedness, and Achieving Global Health Security*. It defines biodefense as actions to counter biological threats, reduce biological risks, and prepare for, respond to, and recover from biological incidents, whether naturally occurring, accidental, or deliberate in origin and whether impacting human, animal, plant, or environmental health. It is broader than a federal government strategy.

The JCP efforts are expected to be published by the end of September. As part of that, the DOE Germicidal Ultraviolet (GUV) Radiation Research and Development Plan is expected to be a stand-alone publication as a federal research and development plan. The DOE authors are leading the development of sections on test and evaluation, economics, and implementation of GUV air treatment. Other roadmap authors include NIST, the National Institute for Occupational Safety and Health (NIOSH) at the CDC, EPA, and NASA. (https://www.whitehouse.gov/wp-content/uploads/2022/10/National-Biodefense-Strategy-and-Implementation-Plan-Final.pdf).

New Journal Article

Faulkner, C.A., Salsbury, T.I., Abboushi, B., Mouchref, C., Singer, B.C., Sohn, M.D., Arnold, G. June 2024. "Comparison of effectiveness and energy use of airborne pathogen mitigation measures to meet clean air targets in a prototypical office building." *Building and Environment*. (https://doi.org/10.1016/j.buildenv.2024.111466). Organizations such as ASHRAE and the CDC have proposed guidelines for controlling infectious aerosols in buildings, which can be met through measures such as modified operation of the heating, ventilation, and air-conditioning (HVAC) system or incorporating air-cleaning technologies. However, more research is needed to understand the trade-offs between health, energy, and comfort aspects when designing measures for these guidelines. To address this gap, this paper presents an analysis using new models for air-cleaning technologies, including

in-duct and in-room GUV systems and portable air cleaners (PACs). These models are incorporated into an existing prototypical office building model, and six measures are designed to meet ASHRAE Standard 241 (Control of Infectious Aerosols) and CDC clean air targets: MERV 13 HVAC filtration; maximum outdoor air supplied to the building; PACs; and in-duct, upper-room, and whole-room GUV. The measures are simulated for an office building in a cool and humid climate compared against a baseline simulation using MERV 8 filtration. The results show that all measures, except for the maximum outdoor air case, can meet the ASHRAE 241 standard without significant impacts on energy or comfort. The HVAC system measures were not able to meet the CDC target with the default system sizing and led to significant energy increases, while the in-room measures were able to meet the CDC target with small impacts on energy consumption. This paper consolidates the simulation findings and provides practical guidance for building operators to meet clean air targets while limiting energy and comfort impacts.

New Journal Article

Jiang, H.A., Li, K., Graham, D.E., Hollander, A.T., Paranthaman, M.P., Muneeshwaran, M., Liu, X., Theodore, M., Aytug, T., An, K., Nawaz, K. January 1, 2024. Quaternary ammonium salt coated air filter for bioaerosol removal from building indoor air. *Building and Environment*. https://www.osti.gov/biblio/2320386. Developing air filters with biocidal ability is important to protect the public from infectious respiratory diseases. A simple spray-coating approach was devised to fabricate antimicrobial air filters to remove bioaerosols. Here, the commercial antimicrobial agent Goldshield 75 was coated on the air filters through covalent immobilization, endowing the fabricated filter with long-lasting biocidal ability. All coated filters significantly inhibited both Gram-positive bacteria (*Micrococcus luteus*) and Gram-negative bacteria (*Escherichia coli*). The antibacterial ability of the coated filters is similar to the commercial AeraSafe antibacterial filter. The coated filter showed over 99.9% antibacterial efficiency 3 months after the application of the coating. Both bacterial and virus filtration efficiencies of coated charged polypropylene filter were higher than 99.9%. The coating did not have much effect on the NaCl aerosol filtration efficiency of the filters. This simple spray-coating strategy is a practical method for producing antimicrobial air filters for the prevention of infectious respiratory diseases.

The Building Technologies Office's Building America Program

Background

Elevating a clean energy economy and skilled workforce, this world-class research program partners with industry to leverage cutting-edge science and deployment opportunities to reduce home energy use and help mitigate climate change.

New Research Publication

Mallay, D. April 2024. *Advanced HVAC Humidity Control for Hot-Humid Climates*. Home Innovation Research Labs for the U.S. Department of Energy Building America Program. DOE/GO-102024-5752. https://www.nrel.gov/docs/fy24osti/83357.pdf. This report explores a cost-effective solution to improve humidity control and comfort for homes in hot-humid climates using conventional equipment with modified control settings. Building efficiency is greater today with better insulated windows, tighter building envelopes, and higher insulated walls, which makes controlling humidity more important than ever. Moisture loads may even be higher due to whole-house mechanical ventilation requirements. This results in moisture loads being greater than total loads, particularly when outdoor temperatures are lower than peak load design temperatures. Modern air conditioning systems do not dehumidify as well

as older, less efficient models due to less moisture load capacity. This means homeowners will lower the thermostat and run air conditioning systems longer in attempt to dehumidify. This doesn't always present the most comfortable climate for the homeowner. Homeowners also have the option to buy a dehumidifier, but those can be costly and difficult to operate and maintain. Home Innovation Research Labs developed a cost-effective solution to dehumidify energy-efficient homes. The strategy was to control indoor humidity through the cooling, dehumidification, and ventilation functions of central, ducted HVAC systems. The team used modified control settings and lower system airflows to optimize dehumidification, while maximizing ventilation during heating and cooling on-cycles and minimizing ventilation during off-cycles when the air handling fan is operating at a low airflow setting. This strategy resulted in controlled indoor humidity to well below goals using conventional equipment that is easy to set up and can be applied across brands, models, and efficiency levels.

New Journal Article

Martin, E., Khan, T., Nigusse, B.A., Withers Jr., C.R. 2024. Estimating internal moisture generation rates in recently constructed, occupied homes in the southeastern United States. *Science and Technology for the Built Environment*. https://doi.org/10.1080/23744731.2024.2327976. Internal moisture generation (IMG), or moisture generated by building occupants via activities such as respiration, cooking, bathing, and cleaning, is a critical input required for design, analysis, and simulation of building enclosure and HVAC systems. Based on previously published values, ASHRAE Standard 160-2021, *Criteria For Moisture-Control Design Analysis In Buildings*, provides guidance for estimating IMG rates for moisture control design analysis, which is based on occupied home datasets collected in the 1980s and 1990s. Residential energy use simulation software also utilizes estimates for IMG for energy rating, energy analysis, and code compliance calculations, as specified in ANSI/RESNET/ICC Standard 301. Data quantifying IMG rates in newer homes are useful in determining the continued relevance of current design and simulation guidance and whether the guidance represents conditions found in new housing stock. ASHRAE Research Project 1844, conducted by the Florida Solar Energy Center (FSEC), a research institute of the University of Central Florida, estimated IMG rates in newer occupied homes built since 2013 in the southeastern United States using a moisture balance model approach. The project obtained occupied home data in cooperation with a DOE Building America research project to characterize IAQ in newer U.S. homes, along with presence, functionality, and occupant use of control measures. Full-scale laboratory homes operating with known IMG rates were used to validate a moisture balance model and quantify the accuracy of estimates obtained when the model is applied to data from occupied homes with unknown IMG rates.

New Fact Sheet

"Scaling Up to Zero Energy Ready—and Down to 530 ft^2" (FSEC Manatee County Habitat for Humanity Case Study) https://www.nrel.gov/docs/fy24osti/88063.pdf. Incorporating high-performance construction technologies into affordable homes can be challenging but first-cost savings from small-scale construction can pay for performance upgrades that reduce long-term costs. The FSEC Energy Research Center provided technical assistance to Manatee County Habitat for Humanity for development of a small, one-bed/one-bath housing design to help address housing availability and affordability constraints. This case study provides guidance for cost-effectively applying Zero Energy Ready Home (ZERH) program measures to small, detached dwelling units and HVAC design for low-load conditions in a hot, humid climate. This included extra work to provide a comfortable humidity.

New Journal Article

Walker, I.S., Less, B.D., Lozinsky, C.H., Lorenzetti, D., Casquero-Modrego, N., Sohn, M.D. 2024. Compartmentalization and ventilation system impacts on air and contaminant transport for multifamily buildings. *International Journal of Ventilation*. https://doi.org/10.1080/14733315.2024.2333669. Provision of acceptable IAQ in multifamily buildings (MFBs) depends on the interior air flows that impact dilution of contaminants, cross-contamination between units and building energy use. The airtightness of interior partitions and design of ventilation systems in MFBs determine the flows across building partitions. These flows change the total ventilation rate for the building and individual units and impact the mixing of air and contaminants between apartment units or with common spaces. This study examines the changes in air flow and contaminant transport in MFBs using combined CONTAM/EnergyPlus models. Key parameters were systematically varied, including climate, apartment airtightness, and mechanical ventilation system type. Simulations were performed for mid-rise buildings with and without an enclosed common corridor and a 20-story high-rise building. Contaminants simulated in the analysis were $PM_{2.5}$, formaldehyde, water vapor, and CO_2. Key results of this work are that current airtightness requirements in ASHRAE 62.2 sufficiently limit transport of key contaminants, independent of the type of ventilation system across all three building typologies, and they significantly reduce energy use in colder climates. The results of this work are intended to assist codes and standards bodies in setting appropriate airtightness limits and ventilation system design guidelines for MFBs.

New Research Report

Jayarathne, T., Browne, M.A., Gevelber, M. 01 January 2024. Development and experimental evaluation of new air leakage measurement methods: Measurement of interior air leaks and comparison to conventional methods." *Science and Technology for the Built Environment*. https://www.osti.gov/biblio/2282847. Building air leaks (both through exterior and interior surfaces) can have a significant impact on energy consumption, IAQ, fire safety, and moisture accumulation affecting structural durability. Blower door testing has been used to measure leaks in buildings, but commonly used testing methods do not directly measure interior leaks. In this paper, new testing methods (guarded interior test and zonal multipoint pressure testing method) are presented that directly measure these interior leaks, utilizing common blower door equipment for both single- and multi-point testing. These new methods are compared to conventional methods in terms of the information provided, limitations, and time/effort needed. In addition, building leak measurement results are analyzed to reveal (a) coupling between power law model values (exponent and coefficient) for an ensemble of buildings, (b) the error in using single-point testing when estimating low pressure leakage, and (c) how building power law models vary from low to high pressure ranges.

New Journal Article

Fix, A.J., Oh, J., Braun, J.E., Warsinger, D.M. April 15, 2024. Dual-module humidity pump for efficient air dehumidification: Demonstration and performance limitations. *Applied Energy*. https://doi.org/10.1016/j.apenergy.2024.122771. This work presents a first-ever experimental demonstration of a "dual-module" vacuum membrane dehumidification configuration that has very high theoretical efficiency. Additionally, perspective is provided on the realistic efficiency limits of the technology using a novel thermodynamic modeling framework. Vacuum membrane air dehumidification is one alternative technology that has emerged as an efficient technology for dehumidification in HVAC systems.

The Building Technologies Office's Efficient and Healthy Schools Program

The DOE Efficient and Healthy Schools program recognized 13 school district honorees at the 2024 White House Summit for Sustainable and Healthy K–12 School Buildings and Grounds: Equity, Learning, Health and Climate, held on April 26, 2024. This Efficient and Healthy Schools program recognizes and assists school districts seeking to implement high-impact IAQ and efficiency improvements. Now honoring a third round of schools, the Efficient and Healthy Schools program's honorees set examples for energy-efficient schools that facilitate effective learning and keep students and teachers healthy. To learn more about honorees' accomplishments visit the Efficient and Healthy Schools website: https://efficienthealthyschools.lbl.gov/20232024-recognition.

On June 11 and 12, The Efficient and Healthy Schools Program and the U.S. Green Building Council (USGBC) Center for Green Schools co-hosted a free, in-person training that focused on identifying, planning for, implementing and funding best practices that intersect decarbonization and IAQ at schools. This event also included a recognition ceremony and reception for this year's honorees of the Efficient and Healthy Schools Program.

On April 17, the Efficient and Healthy Schools Program and the USGBC Center for Green Schools hosted speakers from the ASHRAE 241 committee to answer questions on the newly released CDC and ASHRAE 241 standard, which provides updated ventilation guidance for infectious aerosol control. Speakers from the ASHRAE 241 committee answered submitted questions from a school's perspective on navigating use cases for this updated guidance and shared new free tools available to support building operators with implementation. Additionally, Dr. Kenneth Mead from the CDC's NIOSH answered key questions about ventilation guidance for schools.

Office of State and Community Energy Programs

New Research Report

Shackelford, J., Dutton, S., Regnier, C., Chan, W.R., Robinson, A. Modeled Retrofit Package Performance for Schools. March 2024. *Modeled Retrofit Package Performance for Schools*. https://eta-publications.lbl.gov/sites/default/files/modeled_retrofit_package_performance_for_schools_2024_final_-_jordan_shackelford_1.pdf. The *Modeled Retrofit Package Performance for Schools* report is a resource that can help determine how different retrofit packages can benefit schools. The Package Performance report covers a range of school retrofit opportunities with packages that combine various energy efficiency and electrification measures, summarizing expected package performance for urban and rural schools. Building simulations were run for 10 distinct climate zones, covering a range of U.S. climate conditions. The results include savings predictions for energy, utility cost, and greenhouse gas emissions for each climate zone, as well as estimates of project costs and paybacks. The report begins with a brief description of how the retrofit packages were developed and analyzed, followed by a summary of the packages, including descriptions of health and safety benefits. Savings tables for all of the package options are provided for each climate zone, summarized for urban and rural elementary and secondary school buildings. Appendices supply greater detail users can draw from to conduct specific evaluations. Together, the report provides valuable information to help decision-makers evaluate retrofit package opportunities for their schools. Fact Sheet location: https://eta-publications.lbl.gov/sites/default/files/modeled_retrofit_package_performance_for_schools_2024_final_-_jordan_shackelford_1.pdf

Lawrence Berkeley National Laboratory (LBNL)

New Conference Paper

Zhao, H., Walker, I.S., Delp, W.W., Singer, B.C. Performance and usage of mechanical residential kitchen ventilation. *ASHRAE Winter 2024 Conference Proceedings*. https://eta.lbl.gov/publications/performance-and-usage-mechanical. We reviewed recent lab, field, and survey studies that investigated the performance and occupant use patterns for mechanical kitchen ventilation devices. We have found the following three major issues. Firstly, in-home performance is lower than what was certificated in laboratory testing. The average ratio of installed versus rated flow of 0.76. The lower installed airflows were due to high air flow resistance of duct venting systems, incorrect installation, and dirty hood inlets. Second, the knowledge of range hood performance for pollutant removal before mixing into the room (i.e., capture efficiency) is very limited. We found the capture efficiency was only measured for 57 hoods in nine studies in the United States, either in the lab or in the field. The measured capture efficiency ranged from 10% to 100%, generally increasing with the airflows. The capture efficiency can be influenced by the burner location, hood airflow, range hood geometry, and test conditions. The main reason for limited capture efficiency data was the difficulty in conducting field measurements. Third, was that the actual usage of the kitchen ventilation during cooking is low.

National Institute of Standards and Technology (NIST)

Chemical Assessment of Surface and Air (CASA)

Project Contact: Dustin Poppendieck, 301-975-8423, dustin.popendieck@nist.gov

In Spring 2022, NIST hosted the CASA research campaign. A team of 12 external research groups used environmental and chemical perturbations in the Net-Zero Energy Residential Test Facility (NZERTF) to investigate the chemistry of indoor environments. Chemical transformation induced by ozone, smoke, ammonia, carbon dioxide, insecticide, and volatile organic compounds (VOCs) were investigated. Since the conclusion of empirical testing, environmental and chemical data collected throughout the campaign have fueled an ongoing effort between NIST and several external research groups to create digital twins of the NZERTF and model the chemistry observed within the indoor environment.

An overview paper on the entire project has been recently published. Articles relating to (1) water soluble gases, (2) acid base chemistry, and (3) VOC emissions have been recently submitted to peer-reviewed journals and should be available shortly. A number of other journal articles are being prepared and should be published over the next year.

ASHRAE Standard 62.1

Project Contact: Lisa Ng, 301-975-4853, lisa.ng@nist.gov

The 2022 version of Standard 62.1, *Ventilation and Acceptable Indoor Air Quality*, was published last year by ASHRAE. Among many other changes, the new version of the standard contains the following: a reorganization of Section 5, "Systems and Equipment," to better reflect the path of airflow and the relationship of buildings, systems, and equipment; improvements to the performance-based IAQ Procedure; requirements for a maximum dew-point temperature in mechanically cooled buildings; clarified air density adjustments; and removal of items related to transient occupancies that now fall under Standard 62.2. The committee met at the ASHRAE Annual Meeting in Indianapolis https://www.ashrae.org/conferences/2024-annual-conference-indianapolis.

The April issue of the *ASHRAE Journal* included the airflow and contaminant simulations supporting the writing of the approved ANSI/ASHRAE Addendum a to ANSI/ASHRAE Standard 62.1-2022 on adding a new "Corridor" space type under "Educational Facilities" that requires a per-area ventilation rate that is double the current rate for a "General" corridor. By using the ventilation rate for this space type, schools could reduce annualized CO_2 exposure in the corridors by 11% and exposure to a generic total VOC by 41%. Check out the Hot Air podcast episode on the article that aired on March 24.

ASHRAE Standard 62.2

Project Contact: Steven Emmerich, sjemmeri@nist.gov

The Standing Standard Project Committee (SSPC) 62.2 committee met during the ASHRAE Annual Meeting in Indianapolis on June 21 and 22. Topics discussed included environmental tobacco smoke, an IAQ performance procedure, increasing required filtration level and control of infectious aerosols.

ASHRAE Standard 189.1

Project Contact: Andrew Persily, andyp@nist.gov

The committee responsible for the ASHRAE/ICC/IESUSGBC SSPC 189.1, *Standard for High-Performance Green Buildings Except Low-Rise Residential Buildings*, published an update of the 2020 version of the standard in 2023. This standard will constitute the technical content of the *2024 International Green Construction Code*. The committee holds monthly web meetings, which are open to all interested parties. The committee met at the ASHRAE Annual Meeting in Indianapolis https://www.ashrae.org/conferences/2024-annual-conference-indianapolis. More information on the 189.1 committee activities can be found on the ASHRAE website, where you can sign up for notifications of public reviews and other information at https://www.ashrae.org/technical-resources/free-resources/listserves.

ASHRAE Guideline 44P

Project Contact: Steven Emmerich, steven.emmerich@nist.gov

Proposed ASHRAE Guideline 44P, *Protecting Building Occupants from Smoke During Wildfire and Prescribed Burn Events*, entered a second public review in June 2024. The GPC 44P committee met June 24 and will be considering public review comments following the close of the review period.

ASHRAE Guideline 45P

Project Contact: Lisa Ng, 301-975-4853, lisa.ng@nist.gov

The ASHRAE committee developing a guideline titled *Measurement of Whole Building Performance for Occupied Buildings Except Low-Rise Residential Buildings* has been meeting by webinar every 3 weeks. The committee is rewriting the ASHRAE *2010 Performance Measurement Protocols for Commercial Buildings* into a guideline.

ASHRAE Guideline 241

Project Contact: Steven Emmerich, steven.emmerich@nist.gov

ASHRAE has published Standard 241, *Control of Infectious Aerosols*. The standard establishes minimum requirements for ventilation, filtration, and air-cleaning system design, installation, commissioning, operation, and maintenance to reduce exposure to infectious aerosols. The committee plans to prepare the Standard for a full ANSI public review by the end of the year.

ASHRAE Center of Excellence for Decarbonization

Project Contact: Lisa Ng, 301-975-4853, lisa.ng@nist.gov

On July 1, ASHRAE launched the Center of Excellence for Decarbonization (CEBD), where efforts on decarbonizing the building industry will be coordinated without compromising occupancy safety or the indoor environment. NIST will serve as a liaison on the CEBD to the Environmental Health Committee at ASHRAE.

ASHRAE Environmental Health Committee

Project Contact: Lisa Ng, 301-975-4853, lisa.ng@nist.gov

The *2025 ASHRAE Handbook* chapter, "Indoor Environmental Health," has been significantly updated and will be published next year. Revisions included adding sections on lighting, acoustics, and climate change; adding discussion on ASHRAE 241 and aerosol transmission; and updating the section on bioaerosols.

ASTM: D22.05 Subcommittee on Indoor Air

Project Contact: Dustin Poppendieck, 301-975-8423, dustin.popendieck@nist.gov

The subcommittee has produced a guide (ASTM WK81752 *Guide for Determination of Airborne PFAS in the Indoor Environment*) on analytical methods for the analysis of PFAS in indoor air. The intent of the guide is to help the user understand the range of chemical properties of PFAS found in air, the applicability of various sampling media and extraction methods, and the applicability of various analytical equipment used for detection. This Guide has been approved by the committee and will be published in the upcoming months.

Project Contact: Dustin Poppendieck, 301-975-8423, dustin.popendieck@nist.gov

The subcommittee has also started a workgroup to produce a standard test method for the testing of air cleaning technologies (ASTM WK81750 *Standard Test Method for Chemical Assessment of Air Cleaning Technologies*). This method is designed to be agnostic to the air cleaning technology, quantify the removal performance of multiple target chemicals, and investigate a range of potential byproducts. NIST has conducted the experiments to support method development and provide precision and bias data for the method. A journal article summarizing the NIST data has been recently published (https://pubs.acs.org/doi/10.1021/acs.est.3c09331). This method was balloted for the first time in the summer of 2023. Several negatives are currently being addressed. The item will be re-balloted in fall 2024.

Project Contact: Andrew Persily, andyp@nist.gov

The subcommittee has been revising D6245 *Standard Guide for Using Indoor Carbon Dioxide Concentrations to Evaluate Indoor Air Quality and Ventilation* since 2022. The most recent ballot took place in January 2024, with the results discussed at the D22.05 subcommittee meeting in April. The revised standard was published in June with a slightly different title, *Standard Guide on the Relationship of Indoor Carbon Dioxide Concentrations to Indoor Air Quality and Ventilation*. A new revision of the standard is being initiated to address issues raised during the January ballot.

International Society of Indoor Air Quality and Climate (ISIAQ) Scientific and Technical Committee (STC34)

Project Contact: Steven Emmerich, steven.emmerich@nist.gov

ISIAQ STC34 aims to continuously monitor, collect, and organize information about indoor environmental quality (IEQ) guidelines worldwide. In 2021, STC34 created an open integrated IEQ database that is freely accessible at www.ieqguidelines.org. Currently, STC34 is focusing on outreach efforts, including a planned workshop at Indoor Air 2024 and a book chapter

CO_2 Monitoring Outreach

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The use of CO_2 monitoring in schools and other buildings has increased in efforts to identify poorly ventilated spaces. In support of these and other activities, NIST published a paper titled "Development and application of an indoor carbon dioxide metric" in the *Indoor Air* journal, available as open access (https://doi/10.1111/ina.13059). The paper refers to an online tool, QICO2, that can be used to estimate a space-specific CO_2 concentration based on the target ventilation rate of the space and its occupancy, which can serve as a ventilation rate metric. That tool is available at https://pages.nist.gov/CONTAM-apps/webapps/CO2Tool/#/ and is described in NIST Technical Note 2213 Indoor Carbon Dioxide Metric Analysis Tool, which is available at https://nvlpubs.nist.gov/nistpubs/TechnicalNotes/NIST.TN.2213.pdf.

Germicidal UV (222 nm) Ozone Formation

Project Contacts: Dustin Poppendieck, 301-975-8423, dustin.popendieck@nist.gov, and Michael Link, michael.f.link@nist.gov

In-room GUV using 222 nm wavelengths has recently gained traction as a method to inactivate airborne pathogens. The technology directs 222 nm light onto occupied spaces to minimize the near-field bioaerosol transmission. Previous NIST research demonstrated GUV 222 nm devices produce ozone in a chamber (https://doi/10.1021/acs.estlett.3c00318). To examine the impact of the devices on real-world locations, a GUV 222 nm was placed in a NIST restroom, and the impact of its operation on IAQ was analyzed. A journal article summarizing the results is now available https://pubs.rsc.org/en/content/articlehtml/2024/em/d4em00144c). In addition, results from this effort were shared at the Second International Congress on Far-UVC Science and Technology (or ICFUST) 2024 (June 18–24, 2024). NIST will participate in a workshop summarizing the current state of GUV 222 nm IAQ knowledge and share results of the restroom study at Indoor Air 2024 (July 7–11, 2024). The impact on IAQ of the ozone produced by GUV remains a subject of future NIST studies.

American Council for an Energy-Efficient Economy (ACEEE) Hot Water Forum: Optimizing Hot Water Distribution Systems

Project Contact: Stephen Zimmerman, stephen.zimmerman@nist.gov

Reference buildings, previously developed for energy analyses to support the development of commercial/institutional building energy-efficiency standards, had been further developed to support airflow and IAQ analysis. In recent years, NIST undertook an effort to develop premise plumbing system designs for three residential reference buildings and four commercial reference buildings to support more consistent modeling efforts and has made the designs available for researchers and industry to analyze system performance, new technologies, and design and operation strategies. On March 14, 2024, these designs will be presented and discussed with plumbing system professionals at the Hot Water Forum in Atlanta, GA. More information can be found at: https://www.aceee.org/2024-hot-water-forum-hot-air-forum.

Household and Commercial Products Association

Project Contact: Dustin Poppendieck, 301-975-8423, dustin.popendieck@nist.gov

After publishing a paper comparing chemical emission from Christmas trees (https://doi.org/10.1016/j.indenv.2023.100002) to emissions from common consumer products, the Household and Consumer Products Association (HCPA) reached out to learn more about indoor chemistry for their members, who represent a $170 billion industry. Dustin Poppendieck presented "Primary and Secondary Impacts of Consumer Products on Indoor Air Quality" on May 9, 2024, at the HCPA's midyear convention in Washington, DC. https://www.thehcpa.org/open-events/events-overview/.

CONTAM Multizone Airflow and IAQ Model Developments

Project Contact: W. Stuart Dols, william.dols@nist.gov

CONTAM software developed by NIST is under continuous development. Recent work includes developing a set of application programming interfaces (APIs) to enable the use of CONTAM capabilities within other tools or frameworks and the extension of CONTAM capabilities via other programming environments or platforms. Two APIs are under development that include various bindings to these APIs: *ContamX-API* and *ContamP-API*. *ContamX-API* provides access to the CONTAM simulation engine, *ContamX*, to perform simulations with existing CONTAM projects (PRJ files); *ContamP-API* enables the creation and modification of CONTAM projects. While these are under development, fully functional, pre-release versions of these APIs are available. The *contamxpy* module provides python bindings to the *ContamX-API* and is available via The Python Packaging Index, PyPI at the following link (https://pypi.org/project/contamxpy/). The *contampy* module includes documentation of the module, as well as detailed examples (i.e., python driver programs) demonstrating its usage. *ContamP-API* has been integrated into the *Rhino-Grasshopper* 3D modeling framework via the development of the *ANT* plugin (*ANT* is short for *CONTAMinANT*). ANT allows users to create 3-dimensional building models with Rhino, establish an associated CONTAM model and utilize other plugins to perform a range of analyses. Some example applications of ANT were presented by the developer of the plugin, Dr. Jialei Shen, at the SimBuild 2024 Conference in Denver, CO, in May 2024. The fully functioning beta version of *ANT,* with an example project, is available on the *food4Rhino* application site (https://www.food4rhino.com/en/app/ant).

CDC Indoor Air Updates for Committee for Indoor Air Quality (CIAQ)

National Center for Environmental Health (NCEH)

Division of Environmental Health Science and Practice (DEHSP)

- Dr. Ginger Chew wrote a **book chapter on dust mites and cockroaches** in buildings. The chapter is in the newly published 2nd edition of the American Conference of Governmental Industrial Hygienists (ACGIH) Bioaerosols book: *Bioaerosols: Assessment and Control*. Chapter 25, Dust Mites and Cockroaches, Eds. Marcham CL & Springston JP, published by ACGIH, Cincinnati, OH, 2024.
- Ginger Chew also deployed to Guam after Typhoon Mawar to provide the Guam Department of Health staff **Healthy Homes training with a focus on IAQ, including hands-on demonstration of mold assessment devices.**
    - Training for Environmental Health Specialists focused on IAQ (including mold, pests, dust mites, VOCs, combustion by-products, pet allergens)
        - Objective 1: Understand how exposure to common IAQ contaminants occurs in homes
        - Objective 2: Help building occupants find ways to identify, reduce and remove triggers in their homes

Water, Food, and Environmental Health Services Branch

- **Water quality management in GSA buildings**
  Inadequate water management programs can increase the risk of Legionnaire's disease. On February 15, 2024, the CDC's Dr. Troy Ritter participated in a virtual panel on water quality management in General Services Administration (GSA) buildings. Dr. Ritter presented on tools for controlling *Legionella*. The panel was part of the GSA Client Enrichment Series for federal agency staff involved with property management, lease administration, and industrial hygiene. Download the GSA presentation video, slides, and questions and answers.
- **New streamlined and redesigned CDC.gov means our URLs have changed**
  All URLs across CDC.gov have changed or will change throughout the remainder of 2024. Most old links will continue to work, and smart redirects will automatically direct you from any previous links to corresponding new pages. Explore the CDC's new Legionnaires' disease site and the related sites for controlling *Legionella* and investigating *Legionella* cases.

Agency for Toxic Substances and Disease Registry (ATSDR)

Office of Community Health and Hazard Assessment

- Authors Tonia Burk, Brad Goodwin, and Sandra Miller **presented a poster** titled "The Shape of a Violin: Interpreting Results of the Probabilistic Vapor Intrusion Model vapintr" at the Battelle Chlorinated Conference in Denver, CO, in June 2024.

Office of Innovation and Analytics

- **New publication on microplastics and nanoplastics** in indoor and outdoor air.

Eberhard T., Casillas G., Zarus G.M., Barr D.B. 2024. Systematic review of microplastics and nanoplastics in indoor and outdoor air: identifying a framework and data needs for quantifying human inhalation exposures. *Journal of Exposure Science and Environmental Epidemiology.* 34(2):185–196.

National Center for Emerging and Zoonotic Infectious Diseases (NCEZID)

Mycotic Disease Branch

- **Participated in a working group** hosted by the Healthcare Infection Society (https://www.his.org.uk/) to develop guidelines for the prevention and control of invasive mold disease (aspergillosis, mucormycosis and fusariosis).
- **Published an article** with NCEH colleagues in *The Journal of Allergy and Clinical Immunology: In Practice* describing health care use and health disparities associated with mold exposure diagnosis codes. https://www.sciencedirect.com/science/article/abs/pii/S221321982400268X
- **Updated its website** providing guidance for preventing and investigating health care-associated mold infection outbreaks https://www.cdc.gov/fungal/php/guidance-investigating-outbreaks/mold-healthcare.html

Guidance for Healthcare-Associated Mold Outbreaks

Guidance for healthcare professionals on healthcare-associated mold outbreaks.

www.cdc.gov

U.S. Environmental Protection Agency (EPA), Indoor Environments Division (IED)

Clean Air in Buildings Challenge

The "Clean Air in Buildings Challenge" is a call to action by the Biden–Harris Administration to encourage and assist building owners and operators with reducing risks from airborne viruses, infectious disease, and other contaminants indoors. The Clean Air in Buildings Challenge includes a set of guiding principles and best practices that highlight a range of recommendations and available resources for improving ventilation and IAQ in buildings, which can help to better protect the health of building occupants and reduce the risk of spread of COVID-19 and other infectious disease.

Key actions outlined in the Clean Air in Buildings Challenge include:

- Create a clean indoor air action plan.
- Optimize fresh air ventilation.
- Enhance air filtration and cleaning.
- Conduct community engagement, communication and education.

The White House has invited building owners and operators across the country to join the Administration's efforts to help fight against the spread of infectious disease by publicly pledging to meet the Clean Air in Buildings Challenge. Visit https://www.whitehouse.gov/cleanindoorair/sign-the-pledge/ to take and sign the pledge!

Science

***IED Webinar on NASEM Consensus Study Report* Health Risks of Indoor Exposure to Fine Particulate Matter and Practical Mitigation Solutions**

On April 4, 2024, IED hosted a webinar in the IAQ Science Webinar Series featuring the recent consensus report *Health Risks of Indoor Exposure to Fine Particulate Matter and Practical Mitigation Solutions* published by the National Academies of Sciences, Engineering, and Medicine (NASEM) and sponsored by EPA. During the webinar, Dr. Richard L. Corsi, Dean of Engineering at the University of California, Davis, and Chair of the NASEM consensus study committee presented findings from the report. Committee member Dr. Meredith McCormack of Johns Hopkins University joined Dr. Corsi to answer questions after the presentation. A recording is available on the EPA YouTube channel.

The NASEM consensus study report considers the state-of-the science on the health impacts of exposure to $PM_{2.5}$ indoors, including practical mitigation solutions to reduce exposure in residential settings and highlighting important research needs and key implications of the scientific research. The report is available for download.

NASEM Workshop: Why Indoor Chemistry Matters Workshop 3: Reaching Communities for Action

On April 10, 2024, the NASEM convened "Why Indoor Chemistry Matters Workshop 3: Reaching Communities for Action." This hybrid workshop explored various ways of improving IAQ in homes and public settings. This event was the final workshop in a series of events around the NASEM consensus

report Why Indoor Chemistry Matters, which was co-sponsored by the EPA. For more information about the workshop, visit NASEM's webpage for Workshop 3.

IAQ Emergency Preparedness, Response and Recovery

Support for Preparedness, Response and Recovery to Flooding

In April 2024, IED conducted outreach via GovDelivery mass email and social media (e.g., X) to help guide community preparation for, response to, and recovery from IAQ impacts stemming from flooding. Flood water that enters a home can make the air inside unhealthy. Mold can grow on wood, drywall, carpet, and furniture if they remain wet for more than 24–48 hours. Breathing in mold can affect health. Flood water can also contain bacteria, chemicals, or other hazards that can negatively affect health.

Support for IAQ Preparedness During Hurricane, Wildfire, and Extreme Heat Seasons

In June 2024, EPA is conducting outreach to help communities prepare for IAQ-related impacts during hurricane, wildfire, and heat seasons:

- Webinar in Spanish: "Indoor Air Quality, Extreme Heat and Children's Environmental Health: Overview and Case Studies"
  On June 4, 2024, IED hosted a webinar in Spanish on the impact of extreme heat on IAQ and children's environmental health. The goal of this webinar was to provide attendees with a firm understanding of the level of danger that is present during extreme heat events, as well as tips, strategies, and best practices to help communities adapt. Topics included:
    - Extreme heat and how it impacts children.
    - Extreme heat in Arizona and its impact on child and maternal health.
    - Experiences from the archipelago of Puerto Rico and Hurricane Maria.

- GovDelivery and Social Media Outreach
  On June 12, 2024, IED conducted outreach via GovDelivery mass email and social media (e.g., X) to help guide community preparation for, response to, and recovery from IAQ impacts stemming from hurricanes. Flooding, storm surge, and wind damage from hurricanes can introduce new hazards indoors and worsen existing ones. Flood waters can carry biological and chemical contaminants indoors, and standing water and wet materials can become a breeding ground for viruses, bacteria, and mold. Exposure to these contaminants can cause disease, trigger allergic reactions, and continue to damage materials long after the flood.

  Additional GovDelivery mass email and social media outreach are planned for June 2024 to highlight tips and best practices for preparing for, responding to, and recovering from IAQ impacts of wildfire smoke and extreme heat.

EPA Grants for Wildfire Smoke Preparedness in Community Buildings

IED awarded nine grants ranging from approximately $350,000 to $2 million—totaling more than $10 million—under EPA's new Wildfire Smoke Preparedness in Community Buildings Grant Program. This is a new federal program to enhance community wildfire smoke preparedness by providing grants to states, federally recognized Tribes, public preschools, local educational agencies, and nonprofit organizations. Projects are designed to assess, prevent, control, or abate wildfire smoke hazards in

community buildings that serve the public and that serve disadvantaged communities or vulnerable populations.

The following entities received awards:

- **Arizona Board of Regents, Arizona State University, AZ—**to engage diverse communities in Arizona to develop resilient solutions to the challenges that are posed by wildfires. The project is expected to (1) engage community members with knowledge of indoor air pollution control and associated health fields; (2) evaluate the resilient capacity of facilities to handle the air pollution and heat impacts of wildfires; and (3) implement sustainable solutions in facilities to enhance resiliency towards the air quality and heat impacts of wildfires.
- **Esperanza Community Housing Corporation, CA—**to protect the people of South Los Angeles from wildfire smoke by strengthening wildfire smoke preparedness infrastructure in the Mercado La Paloma building and using the site as the launch pad for a grassroots education and outreach campaign.
- **Colorado Department of Public Health and Environment, CO—**to design and implement a statewide program to provide outreach, education, and training for local community partners on how to prepare for and respond to the public health threat of wildfire smoke.
- **Nez Perce Tribe, Tribal land within boundaries of ID—**to improve public health protection against smoke from wildfires by strengthening preparedness in community buildings. The project will (1) enhance smoke readiness planning, outreach, and training, (2) deploy portable air cleaners, (3) conduct indoor/outdoor air monitoring, (4) complete weatherization, and (5) upgrade HVAC systems. Three community centers, nine public libraries, and four youth centers will be upgraded to provide cleaner air spaces to the public during wildfire smoke events for effective reduction of occupants' exposure.
- **Montana Department of Public Health and Human Services, MT—**to engage a variety of partners to increase wildfire smoke awareness, create and pilot a clean air shelter recognition program in six communities for easy replication in other high need areas, create culturally appropriate and tailored messaging on wildfire smoke and air quality, and provide training to building and facility managers on HVAC maintenance and importance of good IAQ.
- **Oregon State University, OR—**to develop a set of interventions that includes tailored toolkits and resources that can be used by schools, preschools, and daycares to reduce wildfire smoke exposures and increase community resilience across Oregon.
- **Utah Department of Environmental Quality, UT—**to enhance communities' resilience to wildfire smoke by (1) deploying indoor/outdoor low-cost $PM_{2.5}$ and CO_2 sensors at public schools, (2) developing air quality alerts, and (3) distributing air cleaners and filters to public schools/preschools and residents in target underserved areas.
- **Bellingham School District No. 501, WA—**to focus on smoke readiness assessment and planning, as well as indoor and outdoor air quality monitoring.
- **Gonzaga University, WA—**for activities that will reduce indoor exposure to pollutants in wildfire smoke in the City of Spokane and in three community centers serving disadvantaged communities.

For more information, visit our webpage for the Wildfire Smoke Preparedness in Community Buildings Grant Program.

IAQ and Tribal Communities

Tribal Indoor Air Quality Training and Resource Directory

EPA's Tribal Indoor Air Quality Training and Resource Directory is a comprehensive compilation of resources and information to help tribes identify and access various IAQ resources and funding to support the creation or expansion of Tribal IAQ programs. This resource directory, developed by IED in collaboration with the National Tribal Air Association and Institute for Tribal Environmental Professionals (ITEP), is divided into the following sections: Healthy Homes, Schools and Buildings; Asthma; Mold and Moisture; Radon; Commercial Tobacco and Secondhand Smoke; Home Heating, Cooking and Energy; Disaster Preparedness & Mitigation; Disaster Response & Recovery; COVID-19 and Other Pathogens; Funding; Alaska Resource Addendum; and Helpful IAQ Contacts.

IED, in collaboration with Region 8, is continuing to conduct outreach and promote the Resource Directory to Tribal partners. Please visit the Indoor Air Quality in Tribal Communities webpage to learn more and to download the Resource Directory.

State and Tribal Indoor Radon Grants (SIRG) Program

For more than 30 years, IED has provided critical funding to support state, territory, and Tribal efforts to reduce radon-related health risks through the SIRG program. For the first time, in fiscal year (FY) 2024 EPA regional programs established Tribal set-asides for SIRG funding. This is a target percentage of each region's allocation for Tribal awards. The use of Performance Partnership Grants can help Tribes manage the financial matching requirements in SIRG.

For additional information on SIRG funding, see Radon section below.

The Tribal Air Monitoring Support Center (TAMS)

The TAMS Center was created in 1999 through a partnership among Tribes, ITEP and the EPA. It is the first technical training center designed specifically to meet the needs of Tribes involved in air quality management and offers an array of training and support services to Tribal air professionals. Today, the TAMS Center is focused on three main areas of support: training, equipment loans, and professional and technical assistance to Tribes.

The TAMS Center offers training courses that focus on a variety of topics related to ambient monitoring and IAQ. Each course is designed with Tribal audiences and issues in mind and integrates Tribal case studies and Tribal professionals as part of the instructional team. Most of ITEP's technical air quality training courses are conducted at the TAMS Center, located at the EPA National Center for Field Operations in Las Vegas, NV.

The TAMS Center provides an equipment loan program service to Tribes. The listing of equipment that is available for loan can be accessed online. The equipment is typically loaned to Tribes on an annual basis through an Equipment Loan Agreement with the EPA. The purpose of the loan program is to provide Tribal environmental programs access to expensive ambient air monitoring equipment and IAQ diagnostic equipment that they might not otherwise be able to afford.

Professional and technical assistance addresses the following technical topics: air monitor operations and maintenance; air monitor siting; meteorological stations; calibrations and audits; data management; Air Quality System support; quality assistance, quality control, and Quality Assurance Project Plan

development; emissions inventory and Tribal Emissions Inventory Software Solution support; and an array of indoor air issues and pollutants. For more information about the TAMS Program, contact EPA Co-Director Hayden Hardie (hardie.hayden@epa.gov) or Northern Arizona University ITEP Co-Director Christopher Lee (lee.chris@nau.edu), or visit the TAMS Website.

Indoor Environments Division Tribal Newsletter

IED distributes the *Indoor Air Quality Tribal Newsletter* 3–4 times per year to more than 35,000 email subscribers. The newsletter provides the latest news and opportunities for education and engagement on Tribal indoor air topics and identifies tools and resources that can improve the health and the safety of Tribal members on IAQ issues. Please use the following link to be included in our listserv. https://public.govdelivery.com/accounts/USEPAIAQ/signup/37381.

Engagements and Outreach for Spanish-Speaking Communities

IED has one of the most robust Spanish communications and outreach programs within EPA. Spanish-language social media messages (Facebook, Instagram, X, GovD) are considered in all communications and outreach planning strategies. IED's Spanish-language website includes 90 webpages and a host of online fact sheets and infographics where Spanish-speaking visitors can access information in their native language about EPA's tools and guidance to improve IAQ. Throughout the year, IED publishes a quarterly Spanish newsletter that includes information on some of the most current popular topics. These newsletters are not translated from English but rather published exclusively to our Spanish-speaking community. The next Spanish newsletter will be distributed in June 2024.

On April 16, 2024, IED hosted a Spanish webinar on the "Impact of Ventilation and Particulate Matter on Indoor Air Quality." This webinar covered the impact ventilation can have on our homes, what particulate matter is, how it enters the homes and impacts IAQ, and a recent report released by NASEM discussing the health effects of indoor exposure to $PM_{2.5}$ and practical interventions to reduce indoor exposure to $PM_{2.5}$.

On June 4, 2024, IED, in coordination with the EPA Office of Children's Health Protection, hosted the webinar "Indoor Air Quality, Extreme Heat and Children's Environmental Health: Overview and Case Studies," which covered the impact of extreme heat on IAQ and children's environmental health. The goal of the webinar was to give attendees a firm understanding of the level of danger that is present during extreme heat events, as well as tips, strategies, and best practices to help communities adapt.

Household Energy (Cooking, Heating and Lighting in Low- to Middle-Income Countries)

Leadership on Cookstoves/Household Energy

During the past 3 years, the EPA has continued leading an effort to broaden and strengthen a U.S. whole-of-government approach to addressing the global issue of 3.2 million deaths annually from exposure to emissions from polluting cookstoves and fuels. If you or your organization are interested in joining the U.S. government Household Energy Interagency Working Group, please reach out to John Mitchell at mitchell.john@epa.gov.

On May 14, 2024, in Paris, France, the International Energy Agency organized a Clean Cooking Summit for Africa that was co-hosted by the President of Tanzania and the Prime Minister of Norway. U.S. Ambassador Sean Patrick Maloney, the Permanent Representative to the U.S. Mission to the

Organization for Economic Cooperation and Development represented the U.S. government and provided remarks. Ambassador Maloney was joined by Ambassador Jean Manes, the Chargé d'Affairs of the U.S. Mission to the United Nations Educational, Scientific and Cultural Organization, and staff from the EPA, DOE, U.S. Agency for International Development (USAID), and U.S. Department of Agriculture (USDA). The purpose of the Summit was to elevate clean cooking on the global agenda; mobilize financial commitments for clean cooking; and develop a roadmap of concrete, action-oriented strategies around financing, carbon markets, policies and partnerships that will help better mobilize additional support to scale successful clean cooking efforts.

On Tuesday, June 11, 2024, the Embassies of Norway and Tanzania hosted a Clean Cooking event at the Norwegian Embassy in Washington, DC, to follow up the Clean Cooking Summit for Africa. EPA's Alejandra (Ale) Nunez, Deputy Assistant Administrator for Air and Radiation, represented the U.S. government and spoke on a panel about the Biden Administration's whole-of-government approach to this critical issue. Dr. Nunez was joined at the event by clean cooking colleagues from the EPA, DOE, USAID, USDA, U.S. Department of State, and National Institutes of Health. The purpose of the event was to continue the push for greater awareness; showcase partnerships, including with the U.S. government; and promote continued U.S. leadership on global shared challenges.

Cleaner Cooking for Household Energy Emission Reductions With the Clean Cooking Alliance

The EPA works closely with the Clean Cooking Alliance (CCA) through a cooperative agreement to improve climate, environment, health, gender equity, and livelihoods by reducing emissions from household energy in low- to middle-income countries. CCA's core mission is the expansion of clean cooking access to the 2.4 billion people worldwide who lack it. No other intervention has the potential to simultaneously improve human health, reduce emissions of CO2 and short-lived climate pollutants, reduce forest degradation, save women time and drudgery, and improve livelihoods and quality of life. Coordinated national programs are an essential way to achieve significant, sustained expansion of clean cooking at scale. Through this cooperative agreement, CCA will accelerate access to clean cooking through standards-based national policies and country-level climate action, resulting in increased awareness, capacity, and action to increase the sustained use of clean fuels and technologies, as well as emissions reductions in low- to middle-income countries from household energy use.

Two primary CCA initiatives, Nationally Determined Contributions (NDC) work under international climate protocols and developing a cooking and carbon methodology, are discussed in detail below. Additionally, the EPA and CCA continue to support country governments in elaborating national clean cooking priorities and strengthening the capacity of cookstove testing labs to test to the ISO standard, ensuring the effectiveness and safety of stoves promoted around the world.

Working With Countries to Implement Their Nationally Determined Contributions (NDCs)

To date, 98 countries have now included references to reducing emissions from household energy in their Nationally Determined Contributions to the Paris Climate Agreement. The EPA is working with our partners in the Clean Cooking and Climate Consortium (4C) (which includes the CCA, Climate and Clean Air Coalition, Berkeley Air Monitoring Group, Stockholm Environment Institute, and the United Nations Framework Convention on Climate Change), to support countries in meeting their climate goals through clean cooking initiatives. 4C has been hosting a series of expert consultations to facilitate more direct interaction and support to countries in the development of household energy components in their NDCs; organization of their measurement, reporting, and verification activities; financing opportunities; and best practices for scaling clean cooking programs to meet their national climate goals.

Developing a New Clean Cooking and Carbon Methodology

The EPA is working with the 4C on an initiative to drive integrity, credibility, and trust in the cooking and carbon markets by developing a new methodology in line with the latest science for crediting emissions reductions from cookstove projects. Carbon markets play a key role in the pursuit of net zero greenhouse gas emissions and have the potential to provide funding at the scale necessary to bring about substantive transitions in the world's energy systems and economies. To realize this potential, these markets must be able to channel funding toward the most essential solutions to meet the world's global climate goals, including clean cooking. This funding could make clean cooking technologies and clean fuels more affordable and accessible for customers, enabling companies to grow faster and deliver the widespread benefits of clean cooking to new markets.

To take full advantage of the opportunities provided by carbon finance, clean cooking projects must be grounded in sound scientific methodologies, realistic parameters, and conservative assumptions that increase integrity, transparency, and accountability. Building integrity in the cooking and carbon market supports a virtuous cycle wherein credits with higher integrity drive better technologies and incentives for sustained use. This is why the EPA is working with 4C to develop a new methodology for crediting emissions reductions from cooking projects for use under the Paris Agreement and in the voluntary carbon market. This effort will enhance transparency, consistency, and scientific integrity in clean cooking carbon markets, helping deliver affordable clean cooking solutions to the billions currently cooking with inefficient stoves or open fires. By harnessing the power of carbon finance in tandem with gender-responsive approaches, we can ensure that women and children, who today are disproportionately impacted by energy poverty, are not left behind in the energy transition. The draft methodology will be released in summer 2024 for public comment.

State of the Evidence Base Paper

The EPA and its partners are developing a State of the Evidence Base paper for the clean cooking sector, covering research on health, climate, gender, economics, and more. This paper, which is targeted to be completed in 2024, will collect existing knowledge about household energy, identify gaps in research, and help actors set priorities for future efforts in this sector.

Radon

National Radon Action Plan (NRAP)

IED continues to support the growing national network of federal agencies, private-sector groups, nongovernmental organizations, and states to prevent lung cancer deaths through the NRAP. The NRAP presents a long-range strategy for eliminating avoidable radon-induced lung cancer in the United States. The NRAP Leadership Council invites leaders who are serious about preventing radon-induced lung cancer and saving lives to join the NRAP Leadership Council in building in health protection where we live, work, and learn; eliminating preventable disease; and realizing a high return on investment in a healthier future.

Leadership Council members meet monthly to share updates and progress toward the goals outlined in the NRAP. Twice a year, the NRAP holds a longer and more in-depth meeting with all members to evaluate the collective impact of our work and identify continued actions needed to reinforce priority strategies and activities. The Leadership Council held their virtual assessment meeting January 17, 2024, and bimonthly meetings in March and May. The American Lung Association is developing an Interim

Progress Report that provides highlights of progress made under the *National Radon Action Plan 2021–2025*. The report will be finalized this summer.

State and Tribal Indoor Radon Grants (SIRG)

IED continues to support programs aimed at risk reduction through the SIRG Program. For FY2024, the SIRG appropriation is $9.13 million.

FY2024 regional allotments and reports are posted on the EPA's SIRG Resources webpage.

Building Codes and Standards

IED continues to collaborate with industry and states to actively engage in efforts to promote adoption of radon-resistant new construction (RRNC) practices through international, national, state, and local building codes. The EPA works with other radon advocates to present common sense and health protective code changes and work toward consensus. These efforts are mandated by the Indoor Radon Abatement Act and are also a key component of the NRAP. Model codes and standards for RRNC exist in single family, multifamily, and large buildings through ANSI/AARST Voluntary Consensus Standards, IED programs, and green standards for single-family buildings. This includes programs like the EPA's Indoor airPLUS, NAHB 700 and ASHRAE 189.

The International Residential Code (IRC) is the most widely used national building code for residential new construction in the United States that comes from the International Code Council's (ICC) family of national building codes. Appendix F in the IRC was adopted in 1995 to provide RRNC optional requirements if someone were to build a radon-resistant home. An important opportunity for code improvement for Appendix F and the rest of the IRC will happen in 2025 when the EPA will pursue bringing RRNC and testing requirements for radon into the main body of the code.

2024 marks the first year in a new 3-year code cycle for the ICC's I-codes. The work and interest for introducing new code changes in the residential codes will occur in years 2 and 3 of this cycle.

Radon Credentialing

IED's work on radon credentialing is part of the Agency's responsibility to promote and support the availability of quality radon services to the public. Professionals who provide radon testing and mitigation services play a key role in public health protection efforts. In March 2023, the EPA released Proposed Radon Credentialing Criteria to help align and encourage consistency across radon credentialing programs. The nonregulatory criteria are designed to provide a national quality standard for state-run and independent programs that credential radon service providers. The public comment period closed in June 2023. Feedback provided will inform the upcoming final criteria. For more information about the EPA's proposed criteria, visit the EPA radon website at the EPA's Draft Criteria for Radon Credentialing Organizations (https://www.epa.gov/radon/epas-draft-criteria-radon-credentialing-organizations).

EPA's Radon Reference and Intercomparison Program (ERRIP)

As part of annual requirements for secondary radon chambers to be certified to perform radon measurements and calibrations services for the radon industry participating in the National Radon Safety Board, American Association of Radon Scientists and Technologist's National Radon Proficiency Program (AARST-NRPP) and state radon programs, secondary radon chambers participate in the EPA's

ERRIP, managed and operated by the EPA Office of Radiation and Indoor Air's National Analytical Radiation Environmental Laboratory (NAREL), located in Montgomery, AL. NAREL provides the only U.S. radon reference that is NIST-traceable. There are currently three industry-certified secondary radon chambers for use by the U.S. radon community: Bowser-Morner, Inc., Dayton, OH; Kansas State University Radon Chamber, Manhattan, KS; and Spruce Environmental Technologies, Ward Hill, MA.

Asthma

National Environmental Leadership Award in Asthma Management

The 2024 EPA National Environmental Leadership Award in Asthma Management winner, the Maine Asthma Prevention and Control Program (MAPC), was announced in May during Asthma Awareness Month. This is the only national award for excellence in comprehensive asthma management with a focus on environmental interventions for asthma triggers. Maine's program provides leadership and coordination for asthma care and service delivery statewide. One of MAPC's initiatives is the In-Home Asthma Education Program, an innovative, home-based asthma program for adults, children and caregivers who, despite adequate medical management, have asthma that was not well controlled. The program connects those most in need with environmental asthma remediation tools and community resources through health educators who are highly attuned to the disparities that exist in asthma management. You can find more information on MAPC at https://www.epa.gov/asthma/national-environmental-leadership-award-asthma-management#2024winner.

Technical Assistance and Resources

An important component of IED's asthma program is equipping stakeholders with ongoing technical knowledge, and capacity building. This is accomplished through AsthmaCommunityNetwork.org, an online resource that facilitates peer-to-peer engagement and action learning events. Currently, there are over 5,000 members registered. EPA hosts technical webinars throughout the year, which are archived on this website. In addition, AsthmaCommunityNetwork.org features over 600 asthma educational materials in the Resource Bank and offers mentoring opportunities for registered members. You can also find more information on our asthma award winners and sustainable financing. This online network is a great way to engage around Asthma Awareness Month! If you are not a member, consider joining today.

On May 16, 2024, IED hosted a webinar titled "Maine Asthma Prevention and Control Program: Breaking Down Silos to Address IEDOH and Achieve Improved Asthma Outcomes." This webinar highlighted the MACP's award-winning strategies, strong community partnerships, and use of asthma surveillance to drive improvement and sustainability. Eric Frohmberg, Senior Health Program Manager of MAPC, shared how the program fostered a culture of cross-program collaboration to develop and expand asthma control services in the state of Maine, established the Maine In-Home Asthma Education Program (or HAEP), and promoted a culture of evaluation to improve program efficacy and demonstrate improved asthma outcomes. A recording of this webinar will be posted here.

The Asthma Publications Resource One-Pager has QR codes linking to several asthma resources, including guides for asthma triggers, tips for controlling asthma, and a home-visit checklist for health care professionals. Learn how good IAQ contributes to a favorable environment for individuals with asthma. Simply scan the QR codes to access the resources (See Asthma Resources One-Pager PDF).

Federal Collaboration on Asthma Disparities

EPA continues to serve on the Asthma Disparities Subcommittee of the President's Task Force (PTF) on Environmental Health and Safety Risks to Children. The Task Force includes 17 federal agencies and is the focal point for federal government agencies to coordinate for the betterment of children's environmental health. Monthly meetings feature reporting from the PTF's supporting subcommittees that address three priority areas: (1) climate, emergencies, and disasters, (2) asthma disparities, and (3) lead exposures.

EPA also co-leads the Asthma Disparities Workgroup (ADWG). The ADWG is an extension of the Federal Asthma Disparities Action Plan and is co-chaired by the EPA, U.S. Department of Health and Human Services, and U.S. Department of Housing and Urban Development. The goal of the ADWG is to help close the gap in inequities in comprehensive asthma care. During monthly meetings, members discuss strategies to advance the three major priority areas of the Asthma Disparities Subcommittee, which are focused on expanding sustainable financing for in-home asthma interventions, closing research gaps, and creating equitable expectations for asthma outcomes for all patients and caregivers.

Comprehensive IAQ Interventions in Homes

Indoor airPLUS: New Homes

IED's Indoor airPLUS Program (IAP) is a voluntary partnership and labeling program that provides builders with an opportunity to earn a home certification for enhanced IAQ features. IAP certification is also an important prerequisite to achieve both DOE's ZERH label and Passive House Institute US (or PHIUS+) certification. The advent of revised tax credits, which include incentives for DOE's ZERH certification, has prompted a renewed interest from homebuilders and verifiers across the United States, with more than 700 new IAP partnerships in the last 12 months. As a result, IAP certifications in the market have also continued to grow, with over a 20% increase in IAP-labeled homes from FY22 to FY23. The IAP team continues to engage regularly with DOE staff, technical support contractors, and leading industry partners to coordinate important program updates among the suite of federal home certifications and to help facilitate the program adoption that the EPA and DOE are expecting from the incentives in the years ahead.

Indoor airPLUS: Program Updates

In February 2023, the EPA proposed updates to the IAP, including a two-tiered certification program and other changes to strengthen and update program specifications and requirements. The comment period on the proposed updates closed in April 2023. The 2023 proposal was designed to address feedback received on a previous 2020 proposal and to encourage broad industry participation to advance IAQ protections, while strengthening program integrity with an improved verification and quality assurance framework and more training opportunities for partners.

This proposed program update (Version 2) includes a branding update, with a new program naming convention (Indoor AirPlus) and updated logos. Builders will have an opportunity to choose between two labels within the new verification requirements: Indoor AirPlus Certified homes and Indoor AirPlus Gold Certified homes. The proposed "Indoor AirPlus Certified" tier focuses on strategies to improve IAQ without a prerequisite of ENERGY STAR certification. The proposed "Indoor airPLUS Gold Certified" tier includes more advanced protections for improved IAQ in conjunction with ENERGY STAR certification.

Following the comment period that closed in April 2023, the EPA is processing feedback received from program stakeholders and partners, as well as ongoing feedback from other programs within the EPA and DOE, to inform the path forward. The EPA expects to release the final Indoor AirPlus specifications in 2024. During the initial phase of implementation, partners may continue to use Indoor airPLUS Construction Specifications Version 1, Rev.4 or begin to use the new verification requirements for either tier. The EPA anticipates that the Indoor airPLUS Version 1 Construction Specifications will be sunset in early 2026. These dates were chosen to give partners ample time to implement the program changes in Version 2 into their building plans and are subject to change.

Indoor airPLUS: Leader Award Winners

IED will announce the winners of the 2024 Indoor airPLUS Leader Awards in August 2024. The awards recognize market-leading homebuilder and rater partners who construct and verify Indoor airPLUS homes that are designed and built for improved IAQ. Winners have demonstrated exemplary approaches to promoting safer, healthier, and more comfortable indoor environments by offering enhanced IAQ protections and long-term value for new homebuyers with the Indoor airPLUS label. The winners will be formally recognized in October at the Energy and Environmental Building Alliance High Performance Home Builder Summit. During this event, EPA will also announce the Indoor airPLUS Leaders of the Year, awarded to just one builder and one rater, for outstanding program participation and promotion.

Comprehensive IAQ Interventions in Schools

Inflation Reduction Act—Schools Air Quality Grants and Technical Assistance

Provision 60106 of the Inflation Reduction Act (IRA) includes a new $50 million School Air Quality program to improve school IAQ and reduce greenhouse gas emissions, with a particular focus on schools serving low-income, disadvantaged, and Tribal communities. This program will include funding for grants and other activities to monitor and reduce indoor air pollution and greenhouse gas emissions at schools, as well as technical assistance to schools in these communities to address environmental issues; develop school IAQ plans that include standards for school building, design, construction, renovation, and maintenance; and identify and mitigate ongoing air pollution hazards.

In 2023 IED completed a 6-month outreach effort to solicit feedback from the public, nonprofits, industry, Tribes, and agencies across the federal government on how to make the best use of the IAQ school funding provided by the IRA. The feedback provided by well over 500 individuals and organizations has heavily influenced the design of the IAQ grant program and technical assistance activities.

In January 2024, IED posted a Notice of Funding Opportunity on https://www.grants.gov and posted additional information on this webpage. States, Tribes, territories, local governments and educational agencies, and nongovernmental organizations were able to submit applications for grant funding to address indoor air pollution in low-income, disadvantaged, and Tribal K–12 schools until March 19, 2024. The EPA has completed the review of applications and anticipates that grant selections will be announced in Summer 2024 and awards issued in Fall 2024.

EPA Engagements and Webinars on Schools

IED continues to support healthy indoor environments in schools, including after the COVID-19 public health emergency that ended in May 2023. View IED-hosted webinars in the series Healthy Indoor Environments in Schools: Plans, Practices and Principles for Maintaining Healthy Learning Environments.

IED continues to actively deliver technical assistance to the schools community through two professional training webinar series: IAQ Master Class Professional Training Webinar Series and IAQ Knowledge-to-Action Professional Training Webinar Series. Since 2015, both series have had more than 22,000 views from live webinars and on-demand recordings online. IED is working to drive even more action in school districts by spreading the IAQ Master Class Professional Training Webinar Series across more networks and platforms. Please contact us at iaqschools@epa.gov if your organization would like to use your existing training platforms and vehicles to host or link to the webinar series.

Collaboration With Federal Partners to Promote School Environmental Health

The EPA, DOE, and U.S. Department of Education are working to sustain and expand a collaborative partnership on healthy infrastructure, IAQ investments, and health and learning in schools. This collaboration is prioritizing good IAQ in schools as essential for achieving learning outcomes, health and well-being and has a special focus on schools serving low-income communities.

The EPA continues to collaborate with the DOE Efficient and Healthy Schools (EHS) Program. The EHS Program aims to help K–12 schools—especially those serving low-income student populations—identify practical HVAC solutions and upgrades to improve energy efficiency while promoting healthier spaces for teaching and learning. This program promotes peer-to-peer learning among school participants and recognizes schools for their best practices and exemplary solutions. The program also engages such supporters as designers, engineers, consultants, and program implementers to better support schools that are investing in efficient and healthy school buildings.

Expanding the Reach for School IAQ Training

Resources for Healthy IAQ in Schools One-Pager: This one-pager, which is available for downloading and printing, has QR codes linking to several IAQ in Schools resources, including guides for parents, teachers, school administrators, and school maintenance professionals. Learn how good IAQ contributes to a favorable environment for students; improved teacher and staff performance; and a sense of comfort, health, and well-being. In combination, these elements empower schools in meeting their core mission—educating children. Simply scan the QR codes to access the resources. (See the Resources for Healthy Indoor Air Quality in Schools PDF).

IED also continues to promote the *Indoor Air Quality Tools for Schools: Preventive Maintenance Guidance* and *Energy Savings Plus Health: Indoor Air Quality Guidelines for School Building Upgrades* to help school personnel take a holistic, proactive approach to IAQ issues. These resources lead school personnel through the steps to develop and implement an IAQ preventive maintenance plan and offer a framework to make the case using a value proposition for an IAQ preventive maintenance plan and gain buy-in from the school community. These resources can also help to ensure that IAQ is protected and improved during construction and renovation projects in school buildings.

COVID-19

Updated and specific indoor air COVID-19 content can now be found within the IAQ website, https://www.epa.gov/indoor-air-quality-iaq/indoor-air-and-coronavirus-covid-19, which also includes links to multilingual web content on COVID-19 and IAQ.

Consider Subscribing to Email Alerts on IAQ Topics

The EPA offers a free subscription service for information on over 20 indoor air topics—opt-in at https://public.govdelivery.com/accounts/usepaiaq/subscriber/new to receive email updates on IAQ. More than 200,000 subscribers regularly receive announcements of upcoming trainings, webinars, and events, as well as practical tips and information resources to improve IAQ. Subscribers can choose from among 20 topics, such as mold, air cleaners, radon, environmental asthma, air quality in schools, and IAQ emergency preparedness and response. Many topics are also presented in Spanish. Subscriptions can be canceled easily at any time.