

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

June 21, 2022

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

Meeting Overview

- Announcements

- Welcome and Introductions

EPA’s Clean Air in Buildings Challenge

Janet McCabe, Deputy Administrator, EPA

Dave Rowson, Director, Indoor Environments Division (IED), EPA

- Indoor Air Quality (IAQ) Area of Interest Presentation



The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) IAQ Standards—Before, During and After COVID

William Bahnfleth, Ph.D., PE, The Pennsylvania State University; Chair, ASHRAE Epidemic Task Force

- Federal CIAQ Member Agency Updates (Pages 2–23)

U.S. Environmental Protection Agency (EPA), Indoor Environments Division (IED).....	2
Centers for Disease Control and Prevention (CDC)	14
National Institute of Standards and Technology (NIST).....	16
U.S. Department of Energy (DOE).....	20

- Post-Meeting Updates and Announcements

- The next CIAQ meeting is scheduled for October 2022.

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

COVID-19 Update

Important updates to EPA's COVID-19 indoor air content are posted on the EPA website at www.epa.gov/coronavirus. This information helps the public understand the evolving science related to transmission of COVID-19 and what can be done to maximize protections indoors.

The indoor air COVID-19 content on this site is among the most visited EPA web areas and was updated recently to include information on do-it-yourself (DIY) box fan air cleaners. The indoor air COVID-19 content can be found by going to www.epa.gov/coronavirus/indoor-air-and-coronavirus-covid-19.

New Guidance to Help Building Owners and Operators Improve Indoor Air Quality and Protect Public Health: The "[Clean Air in Buildings Challenge](#)" is a call to action and a set of guiding principles and best practices to assist building owners and operators with reducing risks from airborne viruses and other contaminants indoors. The Clean Air in Buildings Challenge highlights a range of recommendations and resources available for improving ventilation and indoor air quality, which can help to better protect the health of building occupants and reduce the risk of COVID-19 spread.

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, and
- Conduct community engagement, communication and education.

For multilingual web content on COVID-19 and indoor air quality (as well as other indoor air environmental health issues), visit www.epa.gov/lep. EPA is continuing to add multilingual content and updating the FAQ list, so please consider checking it routinely.

Science

National Academies Released IED Co-sponsored Consensus Study Report Why Indoor Chemistry Matters

On May 24, 2022, the National Academies of Sciences, Engineering, and Medicine (NASEM) released the consensus study report *Why Indoor Chemistry Matters*. The report is available to download for free from the [National Academies Press website](#).

The report identifies gaps in current research and understanding of indoor chemistry and new approaches that can be applied to measure, manage and limit chemical exposures. It also calls for further research about the chemical transformations that can occur indoors, pathways and timing of indoor chemical exposure, and the cumulative and long-term impacts of exposure on human health,

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including environmental health disparities that affect vulnerable populations. The study was commissioned by EPA, the Sloan Foundation, CDC and the National Institute of Environmental Health Sciences.

NASEM hosted a public release webinar for the report on June 7, 2022. A recording will be made available on the [study webpage](#). EPA also will host a webinar featuring the consensus report on July 7, 2022. [Subscribe for updates](#) from IED on Indoor Chemistry to receive an invitation to the EPA webinar.

National Academies Continuing Work on IED-sponsored Consensus Study Report on Indoor Exposure to Fine Particulate Matter and Practical Mitigation Solutions

The NASEM Committee on Health Risks of Indoor Exposures to Fine Particulate Matter and Practical Mitigation Solutions is conducting a consensus study that will review the recent scientific literature on the health risks of exposure to fine particulate matter indoors and will offer recommendations for engineering solutions and interventions to reduce risks of exposure to it, including practical mitigation solutions to reduce exposure in residential settings. This study will be completed in early 2023. More information can be found on [the study webpage](#).

EPA Resources on Wildfires and Indoor Air Quality Now Include Information About DIY Air Cleaners

If portable air cleaners are not available or affordable, DIY air cleaners are used increasingly as a temporary alternative to commercial air cleaners. DIY air cleaners are made by attaching a furnace filter to a box fan with tape, brackets or a bungee cord and can serve as a temporary alternative to commercial air cleaners.

Recognizing a need for additional information about DIY air cleaners, EPA recently updated several resources on wildfires and indoor air quality with tips for using these devices:

- [Wildfires and Indoor Air Quality \(disponible en español\)](#)
- [Create a Clean Room to Protect Indoor Air Quality During a Wildfire \(disponible en español\)](#)
- Wildfire Smoke Factsheet: [How to Create a Clean Room at Home](#)

Additional information on EPA research investigating the safety and efficacy of DIY air cleaners is available on the EPA/ORD webpage [Research on DIY Air Cleaners to Reduce Wildfire Smoke Indoors](#).

IAQ Emergency Preparedness, Response and Recovery

Weather-related and man-made emergencies and disasters can damage homes and buildings and make the air indoors unhealthy to breathe. With climate change, weather-related emergencies are becoming more frequent and more severe. EPA's [Emergencies and IAQ webpage](#) provides tips on how to prepare for, respond to, and recover from weather-related and man-made emergencies and disasters that affect indoor environments, including wildfires, power outages, hurricanes, flooding and more. This information is now available in multiple languages on EPA's website.

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EPA recently launched a new website on [Flooded Homes Cleanup Guidance](#). This website has a series of videos that are aimed at helping the public perform safe flood cleanup in homes, and general guidance for reducing flood related health and safety risks.

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

Biden Administration Engagement on Cookstoves and Household Energy

In April 2021, President Biden committed to rejoin the Paris Agreement and took executive action to tackle the climate crisis in the United States and other countries. In coordination with the President's action, EPA Administrator Michael Regan also announced that the Biden Administration will resume and strengthen the U.S. commitment to the United Nations Foundation's Clean Cooking Alliance and will work with the Alliance, other country governments and partners at every level to reduce emissions from home cooking and heating that contribute to climate change and affect the health and livelihoods of almost 40 percent of the world's population.

Over the past year, EPA has been leading an effort to broaden and strengthen a whole-of-government approach to addressing this issue. At the 26th meeting of the Conference of the Parties (COP26)—more commonly known as the Glasgow Climate Change Conference—which was held in Glasgow, Scotland, in November 2021, an Energy Access event was organized by EPA and the U.S. Agency for International Development (USAID) and held at the USA Pavilion. During this event, Administrator Regan announced the United States' whole-of-government approach to address this challenge. The hourlong event is [available for viewing online](#). EPA is working with CDC, DOE, the National Institutes of Health (NIH), states and USAID to implement this climate, health, gender and livelihood initiative.

Promotion of International Organization for Standardization (ISO) Standards

The household energy community has completed and issued important standards in the past years through the ISO process. In 2018, ISO published the international standard for Laboratory Testing of Cookstoves, which includes protocols to test and report the emissions, efficiency, safety and durability of cookstoves in a laboratory setting. In 2019, a second ISO household energy standard was finalized, "Guidance on Field Testing Methods for Cookstoves," which provides a framework for testing stoves in actual use conditions.

For the past three years, EPA has been working with the Clean Cooking Alliance, ISO, the World Health Organization, and the Dutch and German development agencies to organize and facilitate regional workshops to promote the adoption or the adaptation by countries of the ISO harmonized laboratory standards for clean cookstoves and clean cooking practices. EPA organized in-person regional workshops for Asia (2018) and Eastern African countries (2019), and in 2020 and 2021, given challenges from COVID-19, it pivoted to a virtual regional workshop series for Francophone African countries and Haiti.

EPA and its partners, now including the Pan American Health Organization (PAHO), recently wrapped up virtual sessions to support the adoption or adaptation and implementation of national standards for cookstoves in Latin American countries. More than 125 stakeholders from the Ministries of Energy, Environment, and Health, national standards bodies, as well as other implementation partners from

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12 countries (Bolivia, Brazil, Chile, Columbia, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay and Peru) participated in this virtual workshop series. EPA is now planning to return to work with the Asia, East Africa and West Africa cohorts and are planning an in-person workshop (if safe to do so) in February 2023.

Advancing Sustainable Household Energy Solutions (ASHES) Initiative at Colorado State University

EPA cooperative agreement recipient Colorado State University, in collaboration with Berkeley Air Monitoring Group, is implementing a household energy solutions and air quality initiative called the Advancing Sustainable Household Energy Solutions, or ASHES. This work includes a webinar series that focuses on disseminating the latest household energy research findings from numerous principal investigators and their organizations. ASHES webinars have highlighted World Health Organization household energy initiatives, EPA Science to Achieve Results (STAR) grantees, and numerous other research programs. For more information on ASHES, or to watch ASHES webinars, please go to www.ashes-csu.org.

Working With Countries to Implement Their NDCs—Nationally Determined Contributions

Every country in the world is required under the Paris Agreement to submit a plan to reduce climate emissions, called Nationally Determined Contributions (NDCs). Seventy-five countries have now included references to reducing emissions from household energy in their NDCs that were submitted at COP26 in Glasgow. This is a great first step for countries to acknowledge the impact that household energy has on climate and for them to begin to take steps to reduce those emissions, which will have knock-on effects on health, gender, environment and livelihoods.

EPA is now working with a consortium of partners—called the Clean Cooking & Climate Consortium (4C)—to support countries in meeting their climate goals by reducing CO₂, methane, black carbon and other short-lived climate pollutants (SLCP). Our external outreach was launched with two webinars in March 2022, with simultaneous translation in French and Spanish.

The Consortium is now hosting a series of expert consultations to facilitate more direct interaction with, and support to, countries. During these virtual sessions, experts will foster a peer-to-peer dialogue among government and other relevant professionals, with expert consultants assisting participants in identifying ways to overcome roadblocks and organize their measurement, reporting and verification (MRV) activities, among other best practices for scaling clean cooking programs to meet their national climate goals. 4C plans to offer this technical support to interested countries in the coming months, growing the breadth and depth of this support over time to ensure that all countries are maximizing their emissions reductions.

Clean Cooking Forum 2022

The Clean Cooking Alliance and partners from around the world are organizing the clean cooking sector's flagship event: the Clean Cooking Forum 2022, taking place October 11–13 in Accra, Ghana. Co-hosted by the Clean Cooking Alliance and the Government of Ghana, the Clean Cooking Forum 2022 will convene global leaders to pave the way for much needed action. Policymakers, entrepreneurs,

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investors, donors and other key partners are expected to join to discuss plans to help bring clean cooking to the billions who live without it. EPA, NIH and other U.S. Government agencies are helping to fund Forum activities, are organizing a “State of the Evidence” workshop on Monday, October 10, 2022, and will be participating in an ISO Plenary Meeting on Friday, October 14, 2022.

Radon

National Radon Action Plan (NRAP)

IED continues to support the growing national network of federal agencies, private sector, nongovernmental organizations (NGOs) and states to prevent lung cancer deaths through the NRAP. In January 2022, EPA and the American Lung Association released the [National Radon Action Plan 2021–2025: Eliminating Preventable Lung Cancer from Radon in the United States by Expanding Protections for All Communities and Buildings](#). This document is a strategy to increase action on radon and sets a goal for the nation to find, fix and prevent high indoor radon levels in 8 million buildings by 2025 and prevent at least 3,500 lung cancer deaths per year.

The NRAP Leadership Council invites leaders who are serious about saving lives; building in health protection where we live, work and learn; eliminating preventable disease; and realizing a high return on investment in a healthier future to join the NRAP Leadership Council.

State Indoor Radon Grants (SIRG)

EPA continues to support programs aimed at risk reduction through the SIRG Program. The fiscal year 2022 (FY 2022) Consolidated Appropriations Act was passed in March 2022. Funding for state and tribal radon grants was appropriated at approximately \$8.295 million. This is an increase of \$500,000 from the previous year. SIRG funding has been transferred to regional account holders and is available for award to states and tribes. FY 2022 regional allotments have been posted and are available on [EPA’s SIRG Program and Resources webpage](#). In alignment with EPA’s current strategic plan, IED encourages regional offices to direct additional funding to new tribal grantees and to encourage state grantees to assist underserved and low-income communities. EPA will work with states and tribes to update their spending plans and to make any necessary adjustments to work plans.

Tribal Performance Partnership Grants

EPA Performance Partnership Grants are being made more accessible to tribes, which will allow tribal grantees to combine funds from multiple environmental program grants into a single grant with a single budget and allow grantees to direct resources where they are needed most to address their environmental and public health priorities.

IED is hopeful this action will create a pathway for additional tribes to successfully apply for and receive radon grant funds and provide additional flexibility for existing tribal radon grant recipients. EPA regions are the lead for communicating with their states and tribal communities about the availability of funds, how to apply, conditions, limitations and how to properly use SIRG funds.

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IED developed and released the [State and Tribal Indoor Radon Grants \(SIRG\) Program Fact Sheet](#) in February. This fact sheet is intended for new and existing tribal grantees, as well as regional tribal air coordinators. It outlines tribal eligibility, matching requirements, background on allowable costs for tribal radon programs and examples of successful tribal radon projects. The fact sheet is available on the EPA website at www.epa.gov/indoor-air-quality-iaq/indoor-air-quality-tribal-communities.

Tribal Indoor Air Quality (IAQ) Training and Resource Directory

IED is working on the IAQ Training and Resource Directory, which is an interactive resource that will help tribes navigate to various IAQ issues of interest and will assist tribes that are looking to start or expand their IAQ programs. This directory includes 10 different sections, including asthma, mold, radon, commercial tobacco smoke, schools and buildings, healthy homes and COVID-19. The content is being specifically designed for tribal community indoor air needs and will be released by the end of Summer 2022.

Building Codes

EPA continues to collaborate with industry and states to actively engage in efforts to promote adoption of radon-resistant new construction practices through international, national, state and local building codes. These efforts are mandated by the Indoor Radon Abatement Act and are also a key component of the National Radon Action Plan.

The most recent code change proposal to remove the EPA radon zone map as a reference document for Appendix F in the International Residential Code was disapproved. EPA wanted to remove the reference to encourage testing and mitigation everywhere regardless of zone. Some of the committee members felt that by taking the map for EPA radon zones out of the code, no guidance would be left for the local building officials to make a determination of how close they are to higher prone areas. The proposal is now undergoing public comment (May 5–June 20) before a final public comment hearing at the end of the year in Louisville, Kentucky (Sept. 11–14).

Radon Credentialing

EPA's work on credentialing of radon service providers 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. Because of the substantial risk resulting from exposure to radon, it is critical for radon service providers to possess the necessary skills to provide quality services and ensure consumer protection. Over the last several years, EPA has been working, through consultation with states, the public and industry—and in response to congressional direction—to develop a contemporary framework to guide the credentialing of radon service providers going forward. EPA remains committed to facilitating access to a qualified workforce through a national, nonregulatory framework that will help establish a quality standard for state-run and independent programs that credential radon service providers. The Agency intends to post an updated proposal online that reflects stakeholder feedback and hold an information session soon. For more information about EPA's proposal, visit the [EPA radon website](#), where EPA will post the most up-to-date information.

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Asthma

Asthma Awareness Month

May provides EPA with increased opportunities to educate stakeholders on the seriousness of asthma and effective strategies that can be implemented to improve the lives of people with asthma. Throughout the month, helpful tips for managing asthma were highlighted through EPA social media accounts. EPA hosted a webinar to recognize the 2022 National Environmental Leadership Award in Asthma Management winner in an effort to showcase and spread best practices from this program. Asthma materials and events hosted by asthma stakeholders across the country were highlighted and promoted through [AsthmaCommunityNetwork.org](https://www.asthmacommunitynetwork.org) and [EPA's Asthma webpage](#).

2022 National Environmental Leadership Award in Asthma Management

This year's 2022 National Environmental Leadership Award in Asthma Management winner, the Utah Department of Health Asthma Program, targets services to communities in need and is distinguished by several innovative projects, such as the Utah Asthma Home Visiting Program and strong partnerships with health care systems. The home visiting program has been shown to reduce severe asthma outcomes through its holistic approach. Referral mechanisms have been established with community services to help address clients' social, mental, physical and emotional needs through partnerships with key health care system partners. Home assessment and trigger remediation services are offered in each county by accessing the county housing authority and local community-based organizations. The Utah Asthma Program's success has resulted in a 75 percent reduction in asthma-related emergency department visits and an 87 percent reduction in asthma-related hospitalizations. And the program is cost effective—generating nearly \$4 in value for every \$1 invested. This outcome data and return on investment helped the Utah Asthma Program secure Medicaid funding to expand the home visit program to rural fee-for-service areas. For more information on this exemplary program, visit www.epa.gov/asthma.

This winning program was featured in a webinar on May 24, 2022, titled *Innovative Strategies and Partnerships to Improve Asthma Outcomes Through a Comprehensive Approach*. The Utah Department of Health presented their award-winning strategies for providing comprehensive asthma care, including in-home environmental trigger management. This webinar equipped participants to replicate these successful approaches in the communities they serve. The webinar should be archived shortly on [AsthmaCommunityNetwork.org](https://www.asthmacommunitynetwork.org).

Asthma Community of Practice

In April 2022, IED convened leaders from across the country for the *Asthma Community of Practice (CoP) Financing Environmental Interventions* webinar. The virtual event convened more than 60 leaders representing federal agencies and regional, state and community-based asthma programs. Asthma CoP members include payers, state Medicaid programs, health care providers and community-level practitioners who are leading innovative work to expand delivery and reimbursement for in-home asthma interventions. The conversation focused on reflections about success within the CoP to secure health care financing for in-home asthma interventions and to explore goals for the next five years to

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improve community asthma outcomes with indoor environmental technical solutions that build onto and beyond expanding financing within health care.

Asthma Disparities

EPA, in collaboration with CDC, HUD and NIH, hosted the Asthma Disparities Workgroup (ADWG) Full Subcommittee meeting on June 6, 2022. The ADWG is composed of more than 60 federal stakeholders committed to coordinating activities and leveraging resources to address nationwide disparities in asthma health outcomes. Discussion topics for this meeting included Asthma Awareness Month activities across agencies, Consumer Product Safety Commission's disparities work, Department of Transportation's health in transportation, CDC's vital conditions framework, EPA's community of practice report, and other agency updates.

AsthmaCommunityNetwork.org

An important component of EPA'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 almost 4,700 members registered. EPA hosts technical webinars throughout the year, which are archived on this website. In addition, AsthmaCommunityNetwork.org features more than 600 asthma educational materials in the Resource Bank and offers mentoring opportunities for registered members. You also can find more information on our asthma award winners and sustainable financing. If you are not a member, join today!

Comprehensive IAQ Interventions in Homes

Indoor airPLUS: New Homes

IED's Indoor airPLUS Program (IAP) is a voluntary partnership and labeling program that helps new home builders address customer health concerns through construction practices and product specifications that minimize exposure to airborne pollutants and contaminants. IAP continues to see sustained growth, with a 36% increase in new partners over the last calendar year, including national production builders positioning their divisions toward a 100 percent commitment. Calendar year 2021 was the largest year on record for new builder partnerships, and IAP verifiers reported more than 10,000 newly labeled homes the same year—a 73 percent increase over 2020. This now represents more than a 10 percent share of the annual certifications in the well-recognized and highly successful ENERGY STAR New Homes program (excluding multifamily high rise and manufactured homes).

In addition to the recent success, EPA would like to see even broader impact in the market for healthier homes, and the Indoor airPLUS team has been working on significant changes to the overall program model and certification scheme in the development of "Version 2." These programmatic updates, along with revised technical specifications, are intended to encourage IAQ upgrades not only in the current high-performance home landscape, but also in the sectors of affordable housing, "code-minimum" construction, and substantial renovations. EPA will release a revised draft of the newly proposed Version 2 program model and certification specifications for public comment in the months ahead.

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The Indoor airPLUS team also will be discussing these new revisions during upcoming webinars and conferences, including the 2022 Energy and Environmental Building Alliance (EEBA) Summit in Scottsdale, Arizona. Indoor airPLUS is one of the co-sponsors of this year's EEBA conference, and the team will be announcing the 2022 Indoor airPLUS "Leaders of the Year" during the event, while also formally recognizing all the 2022 Leader Award winners. This year's award application recently closed, but for more information on the award cycle or to see profiles of previous award winners, visit www.epa.gov/indoorairplus/indoor-airplus-leader-award-winners.

Comprehensive IAQ Interventions in Schools

Indoor Air Quality, Healthy Green Cleaning, and Preventive Maintenance in Schools

As a result of the COVID-19 pandemic, EPA's Schools Program is focused on the increased interest in healthy indoor environments in schools, increased urgency to respond to IAQ issues in schools, and leveraging key partnerships to expand our network of stakeholders. EPA recently participated in several key events and webinars on IAQ in schools.

Indoor Air Quality in Schools in the News

Indoor air quality (IAQ) in schools finally is attracting the serious media attention it deserves. The recent flood of interest nationwide for improving IAQ in schools provides an incredible opportunity for EPA's *IAQ Tools for Schools* program to promote proven IAQ management strategies that protect health and improve academic performance.

These are some of the stories that illuminate and amplify the importance of IAQ for creating healthier learning environments for students and staff. These stories feature several of the technical experts who are champions for our *IAQ Tools for Schools* program.

- *The Washington Post*: "[White House Turns to Air Quality in Latest Effort to Thwart Coronavirus](#)"

March 29, 2022—The Biden Administration promoted its plan to advance better ventilation and filtration to curb to spread of COVID-19 in a recent virtual event hosted by the White House's Office of Science and Technology Policy (OSTP). During this event, Dr. Joseph Allen from the Harvard T.H Chan School of Public Health and EPA's Tracy Enger joined a panel of national experts to amplify the urgency of IAQ in the built environment, especially in the nation's schools.

- NPR's Short Wave: "[Indoor Air Quality is Cool for Schools](#)"

March 28, 2022—Listen in on NPR's daily science podcast Short Wave, as NPR Senior Science and Health Editor Maria Godoy highlights the benefits of improved IAQ in schools, as well as the challenges posed in upgrading aging school buildings in the United States. Also, check out this extensive article from NPR, "[Better Air in Classrooms Matters Beyond COVID. Here's Why Schools Aren't There Yet.](#)"

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- Scripps National News: “[Improved School Ventilation Has Benefits Beyond Preventing the Spread of COVID-19](#)”

March 25, 2022—This story, which was distributed to Scripps syndicated television networks nationwide, spotlights *IAQ Tools for Schools* program resources. It also features an interview with Anisa Heming from the U.S. Green Building Council Center for Green Schools, which details updates schools have already made to air quality systems since the pandemic and outlines what more can be done. To hear more about the great work the U.S. Green Building Council Center for Green Schools is doing to advance IAQ best practices in schools, view the webinar titled [Solutions and Resources to Address COVID-19 in Schools: Establishing Lasting Improvements to Ventilation and IAQ](#).

- NPR’s All Things Considered: “[Better Ventilation Means Healthier Students, But Many Schools Can’t Afford To Upgrade](#)”

March 18, 2022—Originally aired on NPR’s nationally syndicated program All Things Considered, this story focuses on how better IAQ in schools improves academic performance and connects schools seeking to make IAQ improvements to funding opportunities under the American Rescue Plan. Longtime advocate of the *IAQ Tools for Schools* program, Dr. Joseph Allen provides profound insights on the data supporting IAQ improvements in schools. Dr. Allen goes into detail on that research in the webinar titled [Rooted in Research: Reducing Virus Transmission, Improving Ventilation and Promoting Healthy IAQ in Schools](#).

- Inhabit Podcast: “[Putting the ‘I’ in IAQ](#)”

March 9, 2022—On this podcast from the architecture firm Perkins & Will, host Erika Eitland features ways in which school building design impacts IAQ and connects with healthy schools advocates around the country to talk about ways to make an impact in their school districts. Hear more from Erika on the recent webinar titled [Meeting Current School Health Challenges and Beyond: New Tools to Assess and Address IAQ Health and Safety](#).

- E&E News: Greenwire: “[EPA Pushes School Ventilation Upgrades as Mask Mandates Fall](#)”

February 11, 2022—This article, based on the recent EPA webinar titled [Solutions and Resources to Address COVID-19 in Schools: Establishing Lasting Improvements to Ventilation and IAQ](#), outlines two proven IAQ management strategies that the EPA has promoted to reduce pollutants and reduce the spread of viruses and bacteria in schools: ventilation and filtration.

EPA Engagements and Webinars on Schools

EPA continues to support healthy indoor environments in schools during the COVID-19 pandemic. View IED-hosted webinars in the series titled [Healthy Indoor Environments in Schools: Plans, Practices and Principles for Maintaining Healthy Learning Environments](#).

On March 29, 2022, EPA participated in the White House OSTP virtual event titled “Let’s Clear the Air on COVID: An OSTP Discussion on Clean Indoor Air.” OSTP spotlighted the science that shows how taking

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simple, powerful actions to improve IAQ can reduce COVID-19 transmission and produce better overall health outcomes. The event featured public health experts, social scientists, and engineers who discussed how ventilation is a critical part of preventing the spread of future variants and pandemics. EPA shared the history of the Indoor Environments Division's work to improve IAQ in schools, the work ahead, and available resources for improving ventilation in schools.

On April 4, 2022, EPA attended a White House School Event with Vice President Kamala Harris at Thomas Elementary School in Washington, D.C. The event highlighted the Biden Administration's Action Plan for Building Better School Infrastructure. The action plan contains historic investments in clean and efficient school infrastructure and transportation and several initiatives that will improve the learning environment for public school children across the nation. White House National Climate Advisor, and former EPA Administrator, Gina McCarthy was among several speakers who referenced the importance of IAQ improvements as critical to health and energy efficiency. To view clips of the event, visit <https://youtu.be/mUcb15ZxQ00> or <https://youtu.be/FX6gkix-BgU>.

On April 28, 2022, EPA served as a panelist and presented on EPA's available resources for creating healthy IAQ in schools and how to access the resources. The event was hosted by the Northern Arizona University Institute for Tribal Environmental Professionals.

On May 13, 2022, EPA presented during a webinar hosted by the Collaborative for High Performance Schools (CHPS) titled *Equity in Schools: Working towards Restorative Justice*. This webinar is a part of the CHPS Schools Building Science Fridays webinar series. In this session, the discussion focused on the disproportionate impact of poor school building quality on low-income communities and communities of color. By tailoring healthy design and operation strategies, we can work toward restorative justice on a community scale. Case studies were shared from New Orleans, Louisiana, and Boston, Massachusetts.

On May 19, 2022, EPA hosted a webinar titled *You Can't Manage What You Don't Measure: Monitoring IAQ in Schools for Improved Health*. This webinar featured experts from the University of Colorado at Boulder, Integrated Bioscience and Built Environment Consortium, and Boston Public Schools. The experts discussed how to implement cost-effective and comprehensive IAQ monitoring to improve the respiratory health of students and staff by reducing air pollutants and asthma triggers (e.g., viruses, allergens, mold, dust) and how to modify and replicate best practices to monitor IAQ and assess ventilation and heating, ventilation, and air conditioning (HVAC) systems to prevent the spread of COVID-19 in schools and provide healthier indoor air. The recording of the webinar is available at www.epa.gov/iaq-schools/healthy-indoor-environments-schools-plans-practices-and-principles-maintaining-healthy.

On May 20, 2022, EPA gave opening remarks during DOE and Lawrence Berkley National Laboratory (LBNL) webinar series on energy efficiency and IAQ best practices to help school districts improve their facilities. As part of the Efficient and Healthy Schools Campaign, this webinar series provides an opportunity for peer learning and technical exchange among schools and stakeholders. The campaign provides access to experts, tools and resources for schools to get started or further improve monitoring and analytics for HVAC performance.

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On June 2, 2022, EPA hosted a webinar titled *IAQ in Michigan Schools: Improving Indoor Air Quality to Respond to COVID and Beyond*. The webinar featured speakers representing the University of Michigan, LBNL, Michigan Schools Business Officials, Detroit Chapter of ASHRAE, Michigan Department of Environment, Great Lakes and Energy, Michigan Department of Health and Human Services, Michigan Department of Education, Michigan Board of Education, South Lake School District, Detroit Public Schools Community District, Flint Community Schools and Kent Intermediate School District. The webinar focused on the ways Michigan schools can utilize local, state and federal resources to make lasting improvements to IAQ and how to develop a game plan to prepare school staff, update school building ventilation systems, and implement effective, evidence-based IAQ interventions and preventive maintenance practices to reduce virus transmission, create healthy learning environments, and optimize school building energy performance.

Collaboration With Federal Partners to Promote School Environmental Health

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

EPA continues to collaborate with the DOE's Efficient and Healthy Schools campaign. The campaign 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 campaign will promote peer-to-peer learning among school participants and will recognize schools for their best practices and exemplary solutions. The campaign also will engage supporters—such as designers, engineers, consultants, and program implementers—to better support schools that are investing in efficient and healthy school buildings.

EPA participates in the Federal Partners in School Health (FPSH) virtual meetings. The FPSH, coordinated by the U.S. Department of Education, is an alliance of federal agencies that assists and supports the physical and mental health of all students. The FPSH has developed a website inventorying resources promoting healthy school environments for K-12 schools, school districts, and state and local education agencies: studenthealth.ed.gov.

Expanding the Reach for School IAQ Training

EPA also continues to promote the *Indoor Air Quality Tools for Schools: Preventive Maintenance Guidance* documents to help school personnel take a holistic, proactive approach to IAQ issues. The guidance leads school personnel through the steps to develop and implement an IAQ preventive maintenance plan and offers a framework to make the case using a value proposition for an IAQ preventive maintenance plan and gain buy-in from the school community.

EPA continues to actively deliver technical assistance to the schools' community through two professional training webinar series—the [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. EPA is eager to drive even more

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action in school districts through 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.

Consider Subscribing to Email Alerts on IAQ Topics

EPA offers a free subscription service for information on more than 20 indoor air topics—opt-in at public.govdelivery.com/accounts/usepaiaq/subscriber/new to receive email updates on IAQ. More than 145,000 subscribers regularly receive announcements of upcoming trainings, webinars and events, as well as practical tips and information resources to improve IAQ. Subscribers can choose among 20 topics, such as mold, air cleaners, radon, environmental asthma, air quality in schools, and IAQ emergency preparedness and response. Many topics also are presented in Spanish. Subscriptions can be canceled easily at any time.

Centers for Disease Control and Prevention (CDC)

COVID-19 Response

- CDC and the National Institute of Standards and Technology (NIST) worked together to develop an interactive tool that shows how different ventilation strategies can decrease the number of particles in air (including virus particles) in a home when someone visits (e.g., repair person, furniture delivery person, children for a play date). The tool for homeowners and renters is located [here](#). A similar interactive tool was developed for school building managers and administrators. That tool is located [here](#).
- New Publications Related to Indoor Air or Ventilation
 - [Deborah Dowell, MD, MPH; William G. Lindsley, PhD; John T. Brooks, MD. Reducing SARS-CoV-2 in Shared Indoor Air. JAMA. Published online June 7, 2022. doi:10.1001/jama.2022.9970. <https://jamanetwork.com/journals/jama/fullarticle/2793289?resultClick=1>](#)
 - Sanjana Pampati, MPH; Catherine N. Rasberry, PhD; Luke McConnell, MS; Zach Timpe, PhD; Sarah Lee, PhD; Patricia Spencer, PhD; Shamia Moore, MPH; Kenneth R. Mead, PhD; Colleen Crittenden Murray, DrPH; Xiaoyi Deng, MS; Ronaldo Iachan, PhD; Tasneem Tripathi, DrPH; Stephen B. Martin Jr., PhD; Lisa C. Barrios, DrPH. **Ventilation Improvement Strategies Among K–12 Public Schools — The National School COVID-19 Prevention Study, United States, February 14–March 27, 2022.** MMWR Morb Mortal Wkly Rep. 2022; 71:770-775. www.cdc.gov/mmwr/volumes/71/wr/mm7123e2.htm

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National Center for Environmental Health (NCEH)

Division of Environmental Health Science and Practice (DEHSP)

- Webinar Announcement for EH Nexus Webinar: Protecting Yourself from Mold: Myths & Facts
 - Learn how to protect yourself and safely clean up mold after a flood or hurricane. The next Environmental Health Nexus webinar will be *Protecting Yourself from Mold: Myths & Facts*. CDC's subject-matter experts Ginger Chew and Scott Damon, from the National Center for Environmental Health, and Amel Omari, from the National Institute for Occupational Safety and Health, will discuss strategies on how to keep you and your community safe from mold exposure, cleanup methods, and respirator usage during mold remediation.
 - This webinar will broadcast on Wednesday, June 22, 1:00 to 2:00 p.m. ET via Zoom. To register for this event, please visit www.zoomgov.com/webinar/register/WN_JIGO2XdVTQuBSgOVHfaNpg. Live captioning will be available. Visit the Environmental Health Nexus website for more details.

Emergency Management, Radiation, and Chemical Branch

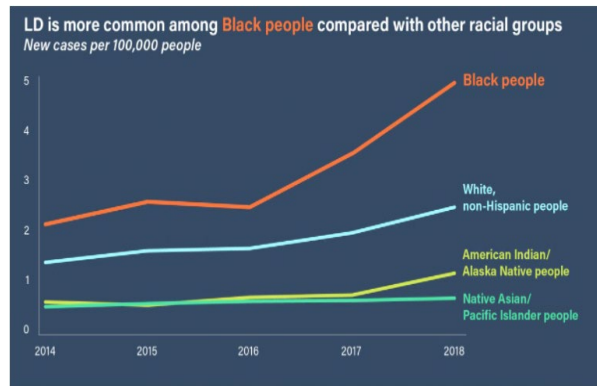
- National Radon Action Month (NRAM)
 - In January 2022, CDC's Radiation and Health newsletter and Environmental Health Nexus newsletter featured information on radon and promoted NRAM. Leading up to NRAM, CDC updated the [radon website](#) with—
 - [Updated resources](#) from partners
 - A [new communication materials](#) landing page featuring a new [3-D animated video](#) and a new animation showing [how radon gets into homes](#)
 - A new page for [health care providers](#) that also was promoted on Medscape for the first quarter of 2022
- CDC's Radon Awareness Week (RAW)
 - The branch led the second annual [Radon Awareness Week](#) January 24 to 28, 2022, the last week of National Radon Action Month. Each day of RAW had a theme highlighting different public health actions and audiences. RAW raises awareness about the combined risk of smoking and radon, shares information about state radon levels and resources, and informs and empowers homeowners, health care providers, and school building managers on steps they can take to reduce risks.

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Water, Food and Environmental Health Services Branch (WFEHSB)

- New tools assist in the environmental component of Legionnaires' disease (LD) outbreaks.
 - DEHSP/WFEHSB recently updated CDC's *Legionella* [environmental assessment form](#). This form can be used to document a facility's water systems, help determine whether to conduct *Legionella* environmental sampling, and, if so, develop a sampling plan. WFEHSB also created a new marking guide—an [instructional resource](#) to help users complete the revised form and increase awareness of conditions that may promote *Legionella* growth and spread.
- Learn about [drivers of health disparities](#) in LD and explore what they mean for future research and practice in DEHSP/WFEHSB's newest plain language summary.
 - LD is increasing in the United States, and Black people and people of lower incomes have higher rates of it. Social determinants of health can help us understand [drivers of health disparities](#), and public health action can help address the increased burden of LD among Black people and people of lower incomes.



www.cdc.gov/nceh/ehs/water/legionella/racial-disparities-LD.html

National Institute for Occupational Safety and Health (NIOSH)

See publication and ventilation tools described in the COVID-19 Response section.

National Institute of Standards and Technology (NIST)

NIST Net-Zero House

The NIST Net Zero Energy Research Test Facility (NZERTF) is a two-story, four-bedroom house incorporating energy-efficient construction, space conditioning systems and appliances, as well as solar water heating and solar photovoltaics to meet the house's energy needs. For general information on the house, view the following video: www.youtube.com/watch?v=xSzu83fyQaQ. All publications can be found at the NIST NZERTF webpage, www.nist.gov/el/nzertf. A tracer gas system that measures both SF₆ and CO₂ has been installed in the home to obtain continuous air change rate measurements and to investigate the performance of CO₂ demand control ventilation and other control approaches. An ozone monitor has been installed to record ozone in each level of the home. A CO₂ heat pump water heater has been installed, and a CO₂ geothermal heat pump will be installed this year.

Contact: Lisa Ng, lisa.ng@nist.gov

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In Spring 2022 the NIST hosted the Chemical Assessment of Surface and Air (CASA) research campaign. A team of 12 external research groups used environmental and chemical perturbations in the NZERTF to investigate the chemistry of indoor environments. Chemical transformation induced by ozone, smoke, ammonia, carbon dioxide, insecticide and VOCs additions were investigated. Real-time instruments used in this campaign included a chemical ionization mass spectrometer (CIMS), two proton transfer reaction–mass spectrometers (PTR-MS), an aerosol mass spectrometer (AMS), a water soluble gas analyzer, and thermal desorption aerosol gas chromatography (SV-TAG) instruments. Formaldehyde, NO_x, ozone and ultrafine particles were measured with other laboratory grade instruments. A range of consumer grade sensors also were deployed throughout the NZERTF during the study. In addition, a variety of surfaces were placed in NZERTF for varying lengths of time to examine the impact of indoor air chemistry changes on surfaces and role surfaces play in impacting indoor air chemistry. These surfaces will be analyzed offsite at collaborator laboratories. Initial data analysis will be presented in six presentations at the Indoor Air 2022 and American Association for Aerosol Research 40th Annual conferences. A number of journal articles are being prepared.

Contact: Dustin Poppendieck, dustin.poppendieck@nist.gov

Single-Zone Simulations Using FaTIMA for Reducing Aerosol Exposure in Educational Spaces

The Fate and Transport of Indoor Microbiological Aerosols (FaTIMA) tool was applied to a classroom, portable classroom and assembly room. NIST evaluated the relative effectiveness of various measures to reduce exposure to infectious aerosols, including masks, increasing ventilation, increasing filtration, using portable air cleaners and using exhaust fans. Multiple controls can be implemented in spaces and HVAC systems to reduce exposure as part of a broader risk reduction strategy that might be pursued by a building owner or manager. As noted by ASHRAE, engineering and other controls should be part of a larger, layered risk reduction strategy that includes hand washing, surface cleaning, social distancing and reduced occupant density. The report can be downloaded here: <https://doi.org/10.6028/NIST.TN.2150>.

In collaboration with the CDC Foundation and CDC, a set of results from the classroom was incorporated into a new interactive tool on the CDC website: www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/interactive-ventilation-tool.html. In this tool, users can select between two HVAC system types and up to four ventilation/filtration options. This tool displays the reduction in particles over the course of a six-hour school day.

Contact: Lisa Ng, lisa.ng@nist.gov

ASHRAE Standard 62.2

The committee responsible for Standard 62.2 on residential ventilation and IAQ will meet via a hybrid in-person webinar in June to continue working on proposed changes. Topics being addressed include changes to kitchen hood capture efficiency, electronic air cleaners, increased required filtration level and unvented combustion appliances.

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

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ASHRAE Standard 189.1

The committee responsible for the ASHRAE/ICC/IESUSGBC SSPC 189.1, *Standard for High-Performance Green Buildings Except Low-Rise Residential Buildings*, is in the process of updating the 2020 version for the next version to be published in 2023. This standard constitutes the technical content of the 2021 *International Green Construction Code*. The committee holds monthly web meetings, which are open to all interested parties. 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 www.ashrae.org/resources--publications/free-resources/listserver.

Contact: Andrew Persily, andyp@nist.gov

ASHRAE Guideline 44P

The ASHRAE committee developing a guideline titled *Protecting Building Occupants from Smoke During Wildfire and Prescribed Burn Events* continues to meet by webinar monthly with a goal of publishing the guideline in the fall of 2022. The interim planning framework document, titled *Planning Framework for Protecting Commercial Building Occupants from Smoke During Wildfire Events*—available online from ASHRAE at tinyurl.com/yxyuqh72—was published last year has been downloaded more than 1,000 times and formed the basis of an EPA Tools & Resources Webinar titled *Preparing for Wildland Fire Smoke* that was presented in May.

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

ASHRAE Guideline 45P

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.

Contact: Lisa Ng, lisa.ng@nist.gov

ASHRAE Position Documents

ASHRAE approved a new *Position Document on Indoor Carbon Dioxide*, which is available online at www.ashrae.org/file%20library/about/position%20documents/pd_indoorcarbondioxide_2022.pdf. An article summarizing the position document was published in the *ASHRAE Journal* in May. ASHRAE also has initiated efforts to revise its Position Documents on *Infectious Aerosols* and on *Limiting Indoor Mold and Dampness in Buildings*.

Contact: Andrew Persily, andyp@nist.gov

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CO₂ Monitoring Outreach

The use of CO₂ monitoring in schools and other buildings has increased in efforts to identify poorly ventilated spaces.

Andrew Persily gave a talk on *Using CO₂ Monitoring to Manage Ventilation in Buildings* as part of the EPA Indoor Air Quality Science Webinar series, which can be downloaded at tsapps.nist.gov/publication/get_pdf.cfm?pub_id=933724.

Contact: Andrew Persily, andyp@nist.gov

Dustin Poppendieck will give a talk on *Using CO₂ as a Ventilation Clue in Classrooms* at the Indoor Air 2022 conference.

Contact: Dustin Poppendieck, dustin.poppendieck@nist.gov

Andrew Persily recently had a paper titled “Development and Application of an Indoor Carbon Dioxide Metric” accepted for publication in the *Indoor Air* journal. If it isn’t posted by the time of the CIAQ meeting, it should be very soon, with a DOI of 10.1111/INA.13059. The paper will be open access. The paper refers to an online tool QICO2 that can be used to estimate a space-specific CO₂ 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 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 nvlpubs.nist.gov/nistpubs/TechnicalNotes/NIST.TN.2213.pdf.

Contact: Andrew Persily, andyp@nist.gov

ASHRAE Green Guide Version VI

The sixth revision of the ASHRAE Green Guide is scheduled to be published Summer 2022. Version VI will target more experienced building professionals, whereas the previous versions contained more introductory content. NIST took the lead editorial roles on the Indoor Environmental Quality (IEQ) and Water Efficiency chapters.

Contacts: Lisa Ng, lisa.ng@nist.gov, and Tania Ullah, tania.ullah@nist.gov

ASTM: D22.05 Subcommittee on Indoor Air

The subcommittee is starting a new effort to produce a guide (*ASTM WK81752 Guide for Determination of Airborne PFAS in the Indoor Environment*) on analytical method for analysis of PFAS in indoor air. The intent of the guide is to help the reader understand the range of chemical properties of PFAS found in air, the applicability of various sampling media, and extraction methods and applicability of various analytical equipment used for detection.

The subcommittee also has 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*

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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.

Other existing standards are continually undergoing review and revision on a 5-year rotation.

Contact: Dustin Poppendieck, dustin.poppendieck@nist.gov

The Subcommittee on Indoor Air is also in the process of revising *D6245 Standard Guide for Using Indoor Carbon Dioxide Concentrations to Evaluate Indoor Air Quality and Ventilation*.

Contact: Andrew Persily, andyp@nist.gov

ISIAQ Scientific and Technical Committee STC34

ISIAQ STC34 aims to continuously monitor, collect and organize information about IEQ guidelines worldwide. In 2021, STC34 created an open, integrated IEQ database that is freely accessible at www.ieguidelines.org. Currently, the database is focused on indoor air quality parameters. The committee continues to meet to extend the database to include standards, regulations and guidelines related to ventilation, comfort, acoustics and lighting.

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

National Academies

The National Academies of Science, Engineering and Medicine released a report titled *Why Indoor Chemistry Matters* (nap.nationalacademies.org/catalog/26228/why-indoor-chemistry-matters) in May 2022. The report identifies gaps in research and understanding related to indoor air chemistry. Dustin Poppendieck (dustin.poppendieck@nist.gov) was a contributing author for this report.

U.S. Department of Energy (DOE)

Agency Point of Contact: Chris Early, 202-586-0514, chris.early@ee.doe.gov

COVID-19 Technical Assistance Program

The COVID-19 Technical Assistance Program (CTAP) provides targeted funding to DOE's National Laboratories system to assist non-DOE entities working to combat the coronavirus pandemic. CTAP gives National Laboratories researchers at 21 DOE laboratories the ability to offer short-term, limited assistance to U.S.-based entities dealing with particularly challenging technical hurdles. For more information, visit labpartnering.org/CTAP.

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The National Virtual Biotechnology Laboratory Addressed Key Challenges Associated With the COVID-19 Crisis

In March 2020, the DOE Office of Science, Biological and Environmental Research Program used funding from the CARES Act for 11 DOE National Laboratories to investigate challenges associated with the COVID-19 crisis. DOE rapidly assembled five project teams to (1) identify new targets for medical therapeutics, (2) develop innovations in testing capabilities, (3) provide epidemiological and logistical support, (4) understand viral fate and transport in the environment, and (5) address supply chain bottlenecks by harnessing extensive additive manufacturing capabilities.

For the aerosol transmission portion of the work, DOE focused on the following three tasks:

- Task 1: Improving Understanding of Drivers of Airborne Transport and Fate Impacting SARS-CoV-2 Transmission in the Built Environment
- Task 2: Understanding the Role of Surface Chemistry and Material Science for Viral Transmission and Spreading
- Task 3: Transport and Emergence of SARS-CoV-2 from Environmental Reservoirs that Contributes to Human Transmission of COVID-19

In December 2021, the National Virtual Biotechnology Laboratory (NVBL) published a summary titled *Report on Rapid R&D Solutions to the COVID-19 Crisis*. It describes all the research results and with respect to the aerosol transmission portion of the research, the report lists 15 publications. The NVBL is planning to publish an update to that December report very soon that will list an additional 15 publications related to aerosol transmission. Following are the titles of some of the most recent reports.

- “High Efficacy of Layered Controls for Reducing Exposure to Airborne Pathogens.” *Indoor Air*, February, 2022.
- “A Missing Layer in COVID-19 Studies: Transmission of Enveloped Viruses in Mucus-Rich Droplets.” [*International Communications in Heat and Mass Transfer*](#), February 2022.
- “Sensitivity of Airborne Transmission of Enveloped Viruses to Seasonal Variation in Indoor Relative Humidity.” *International Communications in Heat and Mass Transfer*, January 2022.
- “Experimental Evaluation of Respiratory Droplet Spread to Rooms Connected by a Central Ventilation System.” *Indoor Air*, 2022.
- (Presentation) “Large Eddy Simulation of Isothermal and Non-Isothermal Turbulent Flows in Ventilated Classrooms.” *13th International European Research Community on Flow, Turbulence and Combustion (ERCOFTAC) Virtual Symposium: Engineering, Turbulence, Modelling and Measurements*. Rhodes, Greece, September 15–17, 2021.

The summary report can be found here: science.osti.gov/nvbl/NVBL-Projects/-/media/nvbl/pdf/NVBL_report.pdf.

The webpage for the overall effort is here: science.osti.gov/nvbl/NVBL-Projects.

DOE Created a Research Status Dashboard So That People Can Find Publications and Resources Related to COVID-19 and Buildings

The Research Status Dashboard is an Excel spreadsheet that also provides key summary information and overview statistics of these publications. There are more than 300 publications from various organizations from all over the world at www.energy.gov/eere/buildings/articles/research-status-dashboard-covid-19-and-buildings.

Scope of Database

Topics related to COVID-19 or coronavirus and buildings, housing, home, HVAC, ventilation, air conditioning, heating, indoor air quality, outside air, filter, filtration, humidity, ultraviolet, energy and electricity.

The database includes publications on—

- Pathogen or COVID-19 transmission within buildings,
- Pathogen or COVID-19 and HVAC systems,
- COVID-19 and building operations,
- COVID-19 and building energy consumption, and
- Pathogen transmission mitigation technologies (e.g., filtration, UVGI, ventilation, etc.).

The database excludes publications—

- Without specific reference to buildings and building operations, *and*
- Focused on occupant behavioral change (e.g., mask wearing, hand washing, social distancing) without reference to building operation or energy consumption.

Webinars About IAQ and Buildings Through the DOE Better Buildings Residential Network

Through this program, [more than 900 commercial, public, industrial and residential](#) energy efficiency programs and partners share their proven energy efficiency strategies to increase the number of buildings that are energy efficient. In the last two years, the network has addressed COVID-19 in its ongoing series of webinars, usually 1 hour, which are called Peer Exchange Calls. DOE brings expert speakers and records the calls and makes them available. Two calls are happening this summer.

[Clear the Air: Healthy Indoor Air for Small Business](#). June 28, 2022, 11:00 a.m. to 12:00 p.m. EDT. This webinar will discuss ways small business owners and building managers can ensure healthy indoor air quality for staff and customers.

[Breathe Easy: Indoor Air Quality in Education Spaces](#). July 28, 2022, 11:00 a.m. to 12:00 p.m. EDT. Students spend most of their day inside at schools, and good indoor air quality is proven to improve student performance, respiratory health, attendance and overall wellness. With an increased focus on indoor air quality, lowering the risk of transmission of infectious airborne diseases is crucial to reduce the risk to students from K–12 through higher education. Learn from subject-matter experts and

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partners about practices to consider in a variety of education spaces, including laboratories and classrooms, that can improve indoor air quality and promote health.

Fourteen calls happened in the last two years.

- [Planning for the Future: New and Improved Pandemic Protocols](#)
- [Health, Efficiency, and Building Operations: Insights from the Pandemic and a Look Ahead](#)
- [Office Buildings and Ventilation: How COVID-19 and Other Pathogens Spread Between Zones](#)
- [Monitoring Healthy Buildings: Using EMIS to Identify Issues with Ventilation, Air Quality, and Thermal Health](#)
- [Navigating Air Purification Technologies During COVID](#)
- [Minimizing Infectious Disease Spread in Buildings: How HVAC Guidance Has Evolved](#)
- [Fault Detection and Diagnostics in the Age of COVID-19](#)
- [Learning from Building Operations During COVID-19](#)
- [Better Plants Online Learning Series: Energy Management During a Pandemic](#)
- [Building-to-Grid Integration in the Context of COVID](#)
- [Getting Ready for Re-opening: Commissioning Experts Discuss Essential System Checks](#)
- [Lighting & Electrical Technology Research Team Webinar—Germicidal UV Lighting](#)
- [Managing Buildings During a Shutdown and Bringing Them Back Online](#)
- [Managing HVAC Systems to Reduce Infectious Disease Transmission](#)

[“Building Operations During COVID-19” Resource Center](#)

DOE’s Building Technologies Office has developed a resource center in the Better Buildings Solution Center to provide information to building operators about COVID-19 mitigation and the associated energy implications. The mix of information was produced by DOE and by others. For DOE-produced information, this website includes four fact sheets on how to operate buildings for the [hospitality](#), [office](#), [retail](#) and [grocery](#) sectors. It provides links to non-DOE resources, such as [ASHRAE’s Epidemic Task Force](#), EPA, CDC, U.S. Green Building Council and many others.

Work by the Lawrence Berkeley National Laboratory Assisting Other Organizations With COVID-19

Following are just a few examples of how the IAQ experts at LBNL worked with national and international organizations on COVID-19.

LBNL provided extensive input to the White House Pandemic Innovation Task Force. With colleagues from EPA, NIST, CDC and other agencies, LBNL helped the task force to develop proposals for projects and activities to support the task force mission, including providing extensive technical input to the high-profile Clean Air in Buildings Checklist formally issued by EPA and the White House.

LBNL worked with the ASHRAE Epidemic Task Force and contributed to ASHRAE guidance on buildings and COVID-19.

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The 42nd Air Infiltration and Ventilation Center conference—“Ventilation Challenges in a Changing World”—will be held in Rotterdam, the Netherlands, together with the 10th TightVent and the 8th Venticool conferences on October 5-6, 2022, and LBNL will participate. The Air Infiltration and Ventilation Center is the International Energy Agency’s information center on energy-efficient ventilation. LBNL worked to create the agenda and presentations.

In December 2020, LBNL published the [SARS-CoV-2/COVID-19 Multidisciplinary Research Strategic Plan](#).

Two More DOE Sponsored Research Reports Related to COVID-19

Ventilation in Residential Care Environments by the University of Nebraska–Lincoln was published in April 2021. The purpose of this study is to evaluate the effect of ventilation rate, directional airflow (e.g., pressure relationships) and airflow barriers on bioaerosol concentration and movement within assisted-living and residential care environments. Included within this report is a comprehensive literature review, field data collection test plan, and an evaluation of commercially available mitigation technologies related to the transmission of SARS-CoV-2 in long-term care environments. One conclusion was that it would have been expected that contaminant loads observed in resident rooms would correspond proportionately to air change rates and, specifically, outdoor air change rates, but results suggest that resident room contaminant loads did not correspond proportionately to air change rates. The study is available at www.nrel.gov/docs/fy21osti/79150.pdf.

Lab Home Testing of Residential Isolation Space Control to Minimize Infectious Disease Transmission in Existing Single-Family Homes was published in May 2021. The Florida Solar Energy Center performed research in its laboratory test house to test the effectiveness of interventions to isolate an ill person recovering from a contagious disease in a single-family home from the rest of the occupants in the home. Focus was placed on interventions requiring minor cost and effort on the part of the occupants. Various controls were implemented under various operating conditions. These strategies were designed based on various heating, ventilating, and air-conditioning operating scenarios, intervention measures, and utilization of exhaust or window fans for pressure control. Interventions involved efforts like closing the isolation zone door and/or sealing isolation zone supply air grilles. The report gives recommendations for establishing an isolation zone/room and how to do it like by sealing off the air vents in the isolated zone of the house, among other recommendations. The white paper is available at www.nrel.gov/docs/fy21osti/79516.pdf. The fact sheet is available at www.nrel.gov/docs/fy21osti/79519.pdf.

DOE Researchers at LBNL Continue to Contribute to IAQ Research and Knowledge Dissemination With Two Technical Reports

The Cost of Decarbonization and Energy Upgrade Retrofits for US Homes was published in August 2021. The report has some discussion of how mechanical ventilation equipment is critical to avoiding IAQ problems after energy upgrades but few such costs are recorded.

“Investigating the Influence of Environmental Information on Perceived Indoor Environmental Quality: An Exploratory Study” was published in the Journal of Building Engineering in May 2022. Authors: [Tang, Hao](#), [Yong Ding](#), [Xue Liu](#), [Brett C. Singer](#). Under the assumption that information can

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impact perception, most research on human sensation and satisfaction with IEQ parameters has been conducted with respondents uninformed about the test conditions. Therefore, researchers know little about the impact of information on perception. These potential effects are increasingly relevant as quantitative information about indoor environments becomes accessible via low-cost, wirelessly connected sensors. In this experimental study, 48 subjects were exposed to varied indoor environmental conditions and provided with different types of environmental information. The subjects' sensation and satisfaction were compared when they were blinded or provided with quantitative information about and/or qualitative ratings of specific parameters. The results indicate that accurate information on parameter values influenced how the subjects perceived the indoor air quality but not how they perceived the thermal, acoustic or visual quality. The subjects rated the IAQ more positively when they were informed that there were nonzero ventilation rates. The qualitative ratings influenced the subjects' perceptions of all four environmental factors, but in different directions. The subjects generally had more positive sensation and higher satisfaction when they were told that the parameter values and qualitative ratings were more favorable than the test conditions. However, the improved sensation and satisfaction were often not as good as when the environmental conditions were actually improved and the subjects were provided with accurate information. These findings affirm the critical need for more research on the impacts of information on perceptions of the indoor environment.

DOE Researchers at Pacific Northwest National Laboratory Also Continue to Contribute to IAQ Research and Knowledge Dissemination

[“Wildfire Smoke Impacts on Residential IAQ”](#) was published by the *ASHRAE Technology Journal* in March 2022.

The DOE Energy Conservation Program for Appliances Publishes Notices Related to How It Regulates Dehumidifiers and Air Cleaners

DOE Issued a “Notice of Availability of Preliminary Technical Support Document, Public Webinar, and Request for Comment Pertaining to Standards for Dehumidifiers” on June 21, 2022. DOE announced the availability of the preliminary analysis it has conducted for purposes of evaluating the need for amended energy conservation standards for dehumidifiers. www.energy.gov/sites/default/files/2022-06/dehum-ecs-prelim.pdf

DOE Issued a “Notice of Final Determination Pertaining to Air Cleaners as a Covered Consumer Product” on June 22, 2022. The DOE has issued a pre-publication *Federal Register* notice determining that air cleaners qualify as a covered product under Part A of Title III of the Energy Policy and Conservation Act. DOE has determined that classifying air cleaners as covered products is necessary or appropriate to carry out the purposes of EPCA. www.energy.gov/sites/default/files/2022-06/air-cleaners-covereddetermination.pdf

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