


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

June 23, 2021

Moderator: Laureen Burton, U.S. Environmental Protection Agency

Meeting Overview

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Gregory Nilsson, Indoor Air Quality Team, Construction Research Center, National Research Council Canada
- Post-Meeting Updates and Announcements
 - The next CIAQ meeting is scheduled for October 2021.

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U.S. Department of Energy (DOE)

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

The DOE Office of Science, Biological and Environmental Research Program Investigated Viral Fate and Transport in the Built Environment, Including Air, Surface and Water Systems

The major focus was on aerosol transmission.

Researchers at Sandia National Laboratories Have Published Three Papers in Scientific Journals

Researchers at Sandia National Laboratories have published three papers in scientific journals on how they used computer simulations to study the droplets of liquid sprayed by coughs or sneezes, how far they can travel under different conditions, and how long they stay in the air. They simulated when a person is and is not wearing a face covering; with and without a breeze; and with and without protective barriers, such as plexiglass. Articles were published in the journals *Atomization and Sprays*, *Applied Mathematical Modelling* and *International Journal of Computational Fluid Dynamics*. Find out about them here: share-ng.sandia.gov/news/resources/news_releases/covid_coughs/.

“Multiscale Airborne Infectious Disease Transmission”

Lawrence Livermore National Laboratory published a review of existing literature about well-established airborne transmission events: www.llnl.gov/news/physics-particle-dispersion-may-lend-insight-reducing-airborne-spread-covid-19-virus.

“Investigation of Potential Aerosol Transmission and Infectivity of SARS-CoV-2 Through Central Ventilation Systems”

“Investigation of Potential Aerosol Transmission and Infectivity of SARS-CoV-2 Through Central Ventilation Systems” comes from a team of researchers at DOE’s Pacific Northwest National Laboratory (PNNL). It was published in the journal *Building and Environment’s* June 15, 2021, issue: www.ncbi.nlm.nih.gov/pmc/articles/PMC7844370/. PNNL undertook a comprehensive modeling and experimental program to evaluate the spread via air handling systems of respiratory droplets, such as those that contain SARS-CoV-2, the virus that causes COVID-19. Researchers looked at the effects of three factors: different levels of filtration, different rates of outdoor air incorporation into the building air supply, and different rates of ventilation or air changes per hour. For rooms connected to contaminated rooms via the ventilation system, they found an expected clear benefit from increasing outdoor air and improving filtering, although these benefits in practice may be less than attributed by idealized models. However, the effect of increased ventilation rate was less obvious. Their study suggests that, in a multiroom building, rapid air exchanges can spread the virus rapidly from the source room into other rooms, increasing short-term infection risk. Their study finds that the larger oral droplets are greatly reduced in size and concentration and limited to their starting room, in contrast to the smaller droplets that originate from the bronchioles and larynx that are much more effective in transiting through the air handling system into connected rooms.

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The DOE Building Technologies Office Recently Published Research Results

“Ventilation in Residential Care Environments”

University of Nebraska–Lincoln. 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: 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”

Florida Solar Energy Center (FSEC). May 2021. White paper: www.nrel.gov/docs/fy21osti/79516.pdf. Fact sheet: www.nrel.gov/docs/fy21osti/79519.pdf. FSEC performed research in a 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. A total of 17 cases were tested. These strategies were designed based on various heating, ventilating and air-conditioning (HVAC) operating scenarios, intervention measures, and utilization of exhaust or window fans for pressure control. Interventions involved such efforts as closing the isolation zone (IZ) door and/or sealing IZ supply air grilles. The report gives recommendations for establishing an isolation zone/room and how to do it, such as by sealing off the air vents in the isolated zone of the house, among other recommendations.

“Research and Development of a Ventilation-Integrated Comfort System”

Steven Winter Associates, Inc. May 2021. www.nrel.gov/docs/fy21osti/78352.pdf. The report describes a research and development effort to lower the cost and ease the integration of energy recovery ventilation systems in low-load homes. The integration reduces space and ductwork needed for separate ventilation systems, and there are no compromises to heating, cooling or ventilation performance. The integrated nature of the device also reduces risks for improper installation and commissioning. They are talking with manufacturers to produce this system.

“Field Validation of a Smart Energy Recovery Ventilation System Using Low-Cost Indoor Air Quality Sensors”

The Southface Institute. March 2021. www.nrel.gov/docs/fy21osti/78662.pdf. The report is a field study of a smart ventilation system that can help low-load homes in humid environments maintain acceptable indoor humidity conditions while providing adequate ventilation. To address the objectives of the study, the Southface team collected field data for 1 year in four Charleston, South Carolina, new construction

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homes to determine the differences in occupant comfort, comfort metrics, IAQ and HVAC energy consumption when toggling biweekly between an energy recovery ventilator (ERV) operating continuously and an ERV operating with smart, time-varying humidity control logic.

Building Technologies Office’s Better Buildings Solution Center, “Building Operations During COVID-19”

DOE’s Building Technologies Office has developed a resource center in the Better Buildings Solution Center, titled “Building Operations During COVID-19” (betterbuildingsolutioncenter.energy.gov/covid19), to provide information to building operators about COVID-19 mitigation and the associated energy implications. This site includes fact sheets developed by the national laboratories for the hospitality, office, retail and grocery sectors. The DOE also has hosted two webinars recently:

- Monitoring Healthy Buildings: Using EMIS to Identify Issues with Ventilation, Air Quality and Thermal Health: June 21.
- Navigating Air Purification Technologies During COVID: March 22.

June 10: The DOE Building Technologies Office Announced \$54 Million in Funding for Small Business Innovation Research Program Research and Development Projects

Four projects deal with indoor air quality (www.energy.gov/eere/buildings/articles/building-technologies-office-funds-21-small-business-rd-building-efficiency):

- PD3 Technologies, Inc., of Huntington Beach, California, will develop a low-cost, self-powered ductless ventilator that can be installed in existing homes and networked with other devices to provide automated climate control without consuming grid energy.
- Ventamatic of Mineral Wells, Texas, will develop a low-cost airflow sensor that can be integrated with residential ventilation fans to provide automatic climate control.
- Burch Energy Services, LLC, of Lafayette, Oregon, will develop a Clean Air Management System that uses indoor air quality sensors and region-specific public health information to adjust buildings’ climate control to improve both efficiency and occupant health.
- Molecule Works, Inc., of Richland, Washington, will develop a new membrane-based air filter with effectiveness equal to or better than existing HEPA filters and an estimated 5-year lifetime.

The DOE Better Buildings Residential Network

The DOE Better Buildings Residential Network, which is a network of more than 400 members that connects energy-efficiency programs and partners to share best practices and learn from one another to increase the number of homes that are energy efficient, recently addressed IAQ in its ongoing series of webinars, which are called Peer Exchange Calls:

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“Smart Range Hoods vs. Indoor Air Quality: Coming to Kitchens Near You Soon”: March 25, www.energy.gov/eere/better-buildings-residential-network/peer-exchange-call-summaries.

Kitchen range hoods can protect Americans from some of the biggest sources of indoor pollution in the kitchen but are noisy and consequently rarely used. Learn about new smart ventilation systems to remove these pollutants in kitchens without having to open your window, as well as the related standards and certifications that already exist.

Lawrence Berkeley National Laboratory Continues Much Work Related to IAQ

Here is a sampling:

- Lawrence Berkeley National Laboratory (LBNL) works with ASHRAE on the Epidemic Preparedness guide.
- For ASHRAE Standard 62.2 (*Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings*), LBNL contributed technically to air inlet-outlet separation distance and capture efficiency specification planning in conjunction with the California Energy Commission.
- LBNL attended IEA Annex 86 (Energy Efficient IAQ Management in Residential Buildings) planning meetings.
- LBNL collaborated with HVI, AHAM, ASTM and IECC to set up the development of an international range hood capture efficiency standard and led the effort to have the International Electrotechnical Commission (IEC) adopt ASTM E3087 (Range Hood Capture Efficiency Standard).
- LBNL gave a RESNET presentation: “The Future of Healthy Homes: Living in the Era of COVID and Wildfires.”
- LBNL presented at the Building Performance Association workshop: “IAQ Science and Science Fiction.”
- Publication from LBNL: “Emissions from Heated Terpenoids Present in Vaporizable Cannabis Concentrates,” *Environmental Science and Technology*, April 2021. The study measured emissions from vaping and dabbing in a laboratory setting. The report describes the concentrations and sizes of various pollutants and how long they stayed in the air. The publication was authored by Xiaochen Tang, Lucia Cancelada, Vi H. Rapp, Marion L. Russell, Randy L. Maddalena, Marta I. Litter, Lara A. Gundel and Hugo Destaillats.

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Centers for Disease Control and Prevention (CDC)

National Center for Environmental Health

Division of Environmental Health Science and Practice

Asthma and Community Health Branch

- CDC's Hurricane Crisis Cooperative Agreement funded four jurisdictions a total of \$1.7 million to assess post-hurricane burden and risk factors among children with asthma. The funded jurisdictions are the Houston Health Department, Texas Department of State Health Services, Puerto Rico Department of Health and U.S. Virgin Islands Department of Health. The projects include activities related to indoor air quality, such as collecting data on post-hurricane indoor mold exposure. These multiyear projects will come to a close in June 2021.
- Recent manuscripts that are related to indoor air quality include the following:
 - Cowan KN, Pennington AF, Gregory T, Hsu J. Impact of hurricanes on children with asthma: a systematic literature review. *Disaster Med Public Health Prep.* 2021 Feb 9;1–6. doi: 10.1017/dmp.2020.424. PMID: 33557998.
 - Cowan KN, Qin X, Ruiz Serrano K, Sircar K, Pennington AF. Uncontrolled asthma and household environmental exposures in Puerto Rico. *J Asthma.* 2020 Dec 21;1-11. doi: 10.1080/02770903.2020.1858861. PMID: 33272056.

Water, Food and Environmental Health Services Branch

- In March 2021, CDC's Jasen Kunz and Elizabeth Hannapel gave the keynote address to more than 400 attendees at a special virtual session of the National Science Foundation/National Environmental Health Association *Legionella* conference. Their presentation included information about two new tools to prevent and control *Legionella* growth and spread:
 - NEW TOOLKIT: Controlling *Legionella* in Common Sources of Exposure—Use this [toolkit](#) for concise, actionable information on controlling *Legionella* in commonly implicated sources of Legionnaires' disease (LD) outbreaks. All modules were developed according to ASHRAE Guideline 12-2020, CDC guidance and other resources.
 - NEW ASSESSMENT FORM: *Legionella* Environmental Assessment Form—Use this [form](#) to document a facility's water systems; help determine whether to conduct *Legionella* environmental sampling; and, if so, develop a sampling plan. This form was updated from outbreak response experiences and to align with ASHRAE Guideline 12-2020.

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- New publication on CDC-led investigations of LD outbreaks
 - Read CDC’s [plain language summary](#) of findings from a new publication on water management gaps and LD outbreaks.
- New publication on *Legionella* investigation in West Virginia
 - The January/February *Journal of Environmental Health* includes a CDC article on a [2018 investigation](#) of LD in workers at a racetrack facility in West Virginia. The environmental assessment of the facility revealed a poorly maintained hot tub in the jockey locker room as the most likely source. Further investigation identified deficiencies in the facility’s ventilation systems, suggesting a transmission mechanism for patients who never entered the locker room floor. The authors concluded that considering indirect exposure routes via air handling systems can be useful for source identification and case finding in legionellosis outbreaks.
- CDC tools for responding to and preventing LD outbreaks
 - Explore more [resources](#) for environmental health practitioners, including training on creating a water management program.

Agency for Toxic Substances and Disease Registry (ATSDR)

ATSDR’s Office of Community Health and Hazard Assessment (OCHHA) is sharing information on a new, longer term system for indoor air sampling at vapor intrusion sites. The traditional method uses a stainless canister to collect indoor air for 8 to 24 hours. However, the new method uses a National Institute for Occupational Safety and Health (NIOSH)–approved capillary controller to extend sampling up to 3 weeks. The extended collection period is ideal for characterizing exposure to such chemicals as trichloroethylene, whose health guidance values are based on a critical 3-week window of exposure. The study was contracted under the U.S. Department of Defense Environmental Security Technology Certification Program. OCHHA is sharing information on the method with its headquarters, regional and state partner programs.

Here is a link to the study: [serdp-estcp.org/Program-Areas/Environmental-Restoration/Contaminated-Groundwater/Emerging-Issues/ER-201504/\(language\)/eng-US](https://serdp-estcp.org/Program-Areas/Environmental-Restoration/Contaminated-Groundwater/Emerging-Issues/ER-201504/(language)/eng-US).

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 web page: 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 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 next year.

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

In the spring of 2022, the NZERTF and NIST will host the Chemical Assessment of Surface and Air research campaign. This follow-up on the HOMEChem research effort is led by Professors Delphine Farmer (Colorado State University) and Marina Vance (University of Colorado). A team of up to 10 external research groups will use environmental and chemical perturbations in the NZERTF to investigate the chemistry of indoor environments. Chemical transformation induced by ozone, smoke and chemical additions will be investigated.

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

Fate and Transport of Indoor Microbiological Aerosols (FaTIMA)

In response to the COVID-19 pandemic, NIST developed an online tool to enable users to consider the effects of several factors on the transmission of and exposure to airborne, virus-containing aerosols. These factors include aerosol size, emission rates and variations in these rates, deposition rates (for walls, floors, ceiling and other surfaces), pathogen inactivation rate, ventilation and filtration. The tool implements a web-based version of the CONTAM simulation engine to simulate a single, well-mixed zone for a 24-hour period. Inputs enable the definition of a source (e.g., infected individuals) to emit aerosols both continuously (breathing) and intermittently (coughing or sneezing). Room dimensions and ventilation system characteristics also are defined, including total supply, return and fraction of outdoor airflow rate. System filters and local exhaust and in-room air cleaners also can be included. An occupant is simulated in the room either continuously or intermittently over a user-defined occupancy period during the 24-hour simulation (e.g., to simulate a caregiver intermittently checking on the infected occupant). The tool will calculate the airborne concentration, occupant exposure and surface loading over the 24-hour period and provide results both numerically and graphically. Transient charts show the time histories and integrated values for concentration and occupant exposure for the 24-hour period and the user-defined occupancy period. Summary charts provide relative percentages of aerosol fate (exited zone, filtered, deposited, deactivated and remained airborne), sources (continuous, intermittent and outdoors), deposition (floor, walls, ceiling and other), and filtration (outdoor, recirculation, air

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cleaner and envelope penetration). A news release and links to the tool and associated documentation are provided below.

News release: www.nist.gov/news-events/news/2020/06/nist-airflow-model-could-help-reduce-indoor-exposure-aerosols-carrying

Link to tool: www.nist.gov/services-resources/software/fatima

Link to documentation: nvlpubs.nist.gov/nistpubs/TechnicalNotes/NIST.TN.2095.pdf

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

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

FaTIMA 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 using 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: doi.org/10.6028/NIST.TN.2150.

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

Introduction to CONTAM Video Tutorials

A set of six tutorials has been released and provided on the NISTube video gallery. Videos can be viewed by visiting www.nist.gov/video-gallery and searching on the “CONTAM” keyword or accessed via the NIST Multizone Modeling website: www.nist.gov/el/energy-and-environment-division-73200/nist-multizone-modeling.

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

Coupled IAQ and Energy Analysis in Multifamily Buildings

NIST will be participating in the International Building Physics Conference, IBPC 2021, in August. A presentation will be made related to the development and application of coupled IAQ and energy modeling. The presentation, titled “On the Benefits of Whole-building IAQ, Ventilation, Infiltration and Energy Analysis Using Co-simulation Between CONTAM and EnergyPlus,” will be accompanied by a conference paper to be made available after the conference has taken place. This presentation is based on the work being performed by NIST and Boston University to model IAQ and energy in residential buildings.

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

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Evaluation of an IECCU Model for Predicting TCPP Concentrations in a Low-Energy Test House

The *Indoor Environmental Concentrations in Buildings with Conditioned and Unconditioned Zones* (IECCU) model was developed by the U.S. Environmental Protection Agency (EPA). A study was completed to evaluate the predictive ability of the IECCU by comparing airborne tris(1-chloro-2-propyl) phosphate (TCPP) concentrations measured from 2013 to 2018 in a test house to modeled predictions. Given the best available inputs, IECCU predicted basement concentrations that were generally higher than, but within a factor of three, of the measurements. The evaluation indicated that further refinement of TCPP emission mass transfer parameters (especially partition coefficient and initial concentration) would improve the accuracy of the IECCU model. A journal article summarizing this effort has been published (www.sciencedirect.com/science/article/pii/S0360132321002948), and the effort will be summarized in a conference proceedings at Healthy Buildings 2021 America.

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

ASHRAE Standard 62.2

The committee responsible for Standard 62.2 on residential ventilation and IAQ met by webinar in May and June to continue working on proposed changes that may be included in the 2022 version of the standard. Topics being addressed include changes to poor ambient air quality, kitchen hood capture efficiency and unvented combustion appliances. The committee will meet again in January.

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

ASHRAE Guideline 44P

The ASHRAE committee developing a guideline titled *Protecting Building Occupants from Smoke During Wildfire and Prescribed Burn Events* has been meeting by webinar monthly with a goal of publishing the guideline in the summer of 2022. The committee was asked to develop an interim framework to address urgent needs as building owners and managers prepare for the 2021 wildfire season. This document, titled *Planning Framework for Protecting Commercial Building Occupants from Smoke During Wildfire Events*, is now available online from ASHRAE at tinyurl.com/yxyugh72.

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

ASHRAE Position Documents

ASHRAE initiated a new *Position Document on Indoor Carbon Dioxide*, which is being drafted and is expected to be approved in early 2022. ASHRAE also has initiated efforts to revise its *Position Document on Infectious Aerosols* and *Position Document on Limiting Indoor Mold and Dampness in Buildings*.

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ASHRAE Standard 189.1

The 2020 version of ASHRAE/ICC/IESUSGBC SSPC 189.1, *Standard for High-Performance Green Buildings Except Low-Rise Residential Buildings*, has been published. The standard will constitute the technical content of the *2021 International Green Construction Code*® (2021 IgCC®). In the area of indoor environmental quality, revisions that have been incorporated into the 2020 standard (and therefore the 2021 IgCC) include an update on the requirements for soil gas control and occupant access to views of the outdoors, as well as other changes. The 2020 standard also includes so-called “jurisdictional options,” which allow adopting jurisdictions to delete selected requirements of the standard if they so choose; the goal of these jurisdictional options is to increase adoption of the IgCC.

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/technical-resources/free-resources/listserves.

Contact: Andrew Persily, andyp@nist.gov

ASHRAE Green Guide Version VI

The sixth revision of the *ASHRAE Green Guide* is underway. Version VI will target more experienced building professionals, whereas the previous versions contained more introductory content. NIST is taking the lead editorial roles on the Indoor Environmental Quality 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 has several efforts underway. Efforts to approve new test standards for carbon dioxide and particulate matter consumer-grade sensors continue. After a 5-year effort, *WK52095 Test Method for Determination of an Emission Parameter for Phthalate Esters and Other Non-Phthalate Plasticizers from Planar Polyvinyl Chloride Indoor Materials for Use in Mass Transfer Modeling Calculations* has passed a full committee ballot. This is the first ASTM test method to determine mass transfer parameters for semivolatile organic compound emissions from building materials. *WK58356 Standard Guide for Measurement Techniques for Formaldehyde in Air* is being balloted at the full committee this summer. Other existing standards are continually undergoing review and revision on a 5-year rotation.

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

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

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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 now posted on the webpage www.epa.gov/coronavirus/indoor-air-and-coronavirus-covid-19. These updates reflect IED analysis of the evolving science related to transmission of COVID-19, further highlighting airborne transmission indoors as a primary route of exposure and noting that transmission of COVID-19 from inhalation of the virus in the air can occur at distances greater than 6 feet, particles from an infected person can move throughout an entire room or indoor space, and particles also can linger in the air after a person has left the room and can remain airborne and infectious for hours in some cases.

FAQs specific to indoor air quality (IAQ) issues are available at www.epa.gov/coronavirus/frequent-questions-about-indoor-air-and-coronavirus-covid-19.

EPA's indoor air COVID-19 guidance and FAQs include links to additional resources for managing IAQ, including relevant CDC guidance, to help provide protection against airborne transmission of COVID-19 in homes, schools, offices and other commercial buildings.

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 this FAQ list, so please consider checking it routinely.

For the latest information on EPA's overall COVID-19 guidance and response, visit www.epa.gov/coronavirus.

Science

Webinar on Air Cleaning for COVID-19

IED hosted a webinar on June 16, titled "Navigating the Landscape of Air Cleaning Technologies for COVID-19." Brent Stephens from Illinois Institute of Technology and Elliott Gall from Portland State University provided insights on commercially available air cleaning technologies, as well as recommendations and tools for selection and evaluation of portable and in-duct air cleaners, as a part of a layered approach to reduce exposure to SARS-CoV-2. The webinar has been recorded and will be available soon at [EPA—Indoor Air Quality Science and Technology | Webinars](#).

New: Wildfire Smoke and IAQ Guidance

EPA has developed a new webpage on [Wildfire Smoke and IAQ for Schools and Commercial Buildings](#) that provides several resources for building owners and managers, school facility managers, public health officials and emergency managers to reduce smoke concentrations in buildings—including in dedicated cleaner air spaces—during wildfires and prescribed burns. This page also features the

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[Planning Framework for Protecting Commercial Building Occupants from Smoke During Wildfire Events](#) from ASHRAE that recommends HVAC and building measures to minimize occupant exposures and health impacts from smoke during wildfire and prescribed burn smoke events. The ASHRAE Planning Framework was also the subject of a recent EPA stakeholder outreach message.

New: Indoor Air Quality and Climate Change Webpage

IED recently published its new [Indoor Air Quality and Climate Change](#) webpage. The new webpage outlines how climate change may impact the indoor environment and human health. The webpage also provides information on IED's portfolio of climate change resources, publications and links to available climate change research. The webpage features resources that provide strategies for adapting homes and buildings to climate change impacts to maintain a safe and healthy indoor environment. Additionally, it provides access to EPA-commissioned reports and white papers on topics related to climate change, the indoor environment and health. These publications served as inputs to an Institute of Medicine expert committee and report, [Climate Change, Indoor Environment and Health](#). Lastly, the webpage summarizes nine EPA-sponsored research projects on climate change and indoor air quality.

IED-Sponsored Particulate Matter and Mitigation Workshops Posted on the EPA Website

Videos and slides from the recent IED-sponsored National Academies of Sciences, Engineering and Medicine (NASEM) workshops on Indoor Exposure to Fine Particulate Matter and Practical Mitigation Approaches in April have been posted on the NASEM website. The April workshops information can be viewed online: April 14, *Sources of Indoor Fine Particulate Matter* [session website](#); April 21, *Indoor PM Exposure Health, Metrics, and Assessment* [session website](#); April 28, *Mitigation of Indoor Exposure to Fine Particulate Matter* [session website](#).

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

President Recommits Work With Clean Cooking Alliance During the Climate Leaders Summit

In April, 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 Agency will resume and strengthen its 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 affects the health and livelihoods of almost 40 percent of the world's population.

Promotion of ISO Standards

The household energy community has completed and issued important standards in the past 2 years through the International Organization for Standardization (ISO) process. In 2018, ISO published the international standard *Laboratory Testing of Cookstoves*, which includes protocols to test and report the emissions, efficiency, safety and durability of cookstoves in a laboratory setting. The new standards serve as the basis for national policies and programs on cookstoves, while also incentivizing

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manufacturers and developers to improve stove quality and performance. In 2019, a second ISO household energy standard was finalized—*Guidance on Field Testing Methods for Cookstoves*—which provides a framework for organizations, countries and regions to adapt and implement cookstove protocols, metrics and targets based on their priorities over the coming months and years. EPA now is 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 recently finalized ISO harmonized laboratory standards for clean cookstoves and clean cooking practices.

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

EPA cooperative agreement recipient Colorado State University, in collaboration with the Berkeley Air Monitoring Group, began a new household energy solutions and air quality initiative. Through the ASHES Initiative, Colorado State is building a consortium of household energy community members that includes researchers, academics, practitioners, private industry and community partners working together to define the way forward and advance sustainable household energy solutions for public health and environmental sustainability. This work includes a webinar series that focuses on disseminating the latest on household energy. In past months, ASHES has worked with EPA to highlight the research findings from each of the six EPA Science To Achieve Results grants on household energy, as well as related ongoing research by each of the principal investigators and their organizations. For more information on ASHES, or to watch previous ASHES webinars, please go to www.ashes-csu.org.

Radon

National Radon Action Plan (NRAP)

IED continues to support the growing national network of federal agencies, private sector and nongovernmental organizations (NGOs), and states to prevent lung cancer deaths through the NRAP. Along with its founding members, the American Lung Association (ALA) has brought in supporting organizations (those who have signed a declaration of support) and emerging potential partners (organizations identified to help drive progress) to increase the mitigation of existing homes and the construction of new homes with radon-reducing features. The NRAP expands the efforts under the Federal Radon Action Plan to focus on actions that go beyond federal governmental actions alone.

The NRAP presents a long-range strategy for eliminating avoidable radon-induced lung cancer in the United States. The Plan's near-term goals are to reduce radon risk in 5 million homes and save 3,200 lives. While these goals offer bold and important milestones, the NRAP's ultimate goal is to eliminate avoidable radon-induced lung cancer in the United States by incorporating radon testing, radon mitigation and radon-resistant construction into the systems that govern purchasing, financing, constructing, and renovating homes and other buildings. Progress for NRAP strategies can be tracked at www.radonleaders.org/resources/nationalradonactionplan.

EPA and the ALA released the [*Reflections on National Radon Action Plan's \(NRAP\) Progress, 2015–2020 Report*](#) on April 2. This document describes the progress in lives saved; strategic impact with the plan; and an ongoing collaboration between EPA, ALA, and 13 other federal and national organizations

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committed to saving lives from radon-induced lung cancer. For the last 5 years, NRAP partners have made progress toward this bold goal by building radon testing and mitigation practices into the systems that govern purchasing, financing, constructing and renovating buildings; creating incentives and funding for radon risk reduction; disseminating professional standards; and raising awareness of radon risk. NRAP efforts have already contributed to saving between 1,800 and 2,000 lives annually by 2020, and work completed to date through the Federal Housing Authority will save between an estimated 13,000 to 26,000 total lives over time.

State Indoor Radon Grants (SIRGs)

The Fiscal Year (FY) 2021 Consolidated Appropriations Act was passed in December 2020. SIRG funding was appropriated at \$7.795 million for FY 2021, slightly more than the \$7.789 million from FY 2020. EPA regions are negotiating work plans and awarding 2021 radon grants to states and tribes.

In March, EPA finalized the 2020 Annual SIRG Activities Report. This report highlights the important work that states, territories and tribes are undertaking across the country to advance risk reduction. The 2020 SIRG Activities Report highlights many new success stories and a strong commitment to this important public health issue. The report also spotlights EPA's 50th anniversary, new U.S. Department of Housing and Urban Development Multifamily Accelerated Processing Guidance, and efforts to expand coverage and assist underserved communities. A link to the report is available on EPA's [SIRG Resources webpage](#).

EPA's [SIRG Resources webpage](#) includes general SIRG information, a link to the grants.gov applications, guidance from the Agency regarding work planning and funds utilization in the face of challenges due to the COVID-19 pandemic, and other useful information.

2021 Radon Webinar Series

The Conference of Radiation Control Program Directors (CRCPD) and American Association of Radon Scientists and Technologists (AARST), in partnership with EPA's IED, are hosting a series of radon webinars throughout 2021. Early webinars on radon in schools and cancer control plans drew broad audiences and featured speakers from local school districts, state cancer consortiums, state and tribal radon programs, CDC, and EPA. Announcements about the webinar series will be shared through several networks (including CRCPD, AARST and EPA), and additional details about upcoming webinars and registration information will be posted on www.radonleaders.org.

Radon Standards of Practice

EPA issued updated guidance recommending that states and other recipients of SIRGs reference the most current voluntary consensus-based standards when implementing their radon programs (dated April 2020). The updated guidance includes the latest construction standards but otherwise remains consistent with the previous version (dated August 2019). (Available on the [SIRG Resources webpage](#).)

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Building Codes

EPA continues to collaborate with industry and states to actively engage in efforts to promote the 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 NRAP.

EPA is working with key radon stakeholders to draft code changes or introduce new code requirements in several different areas within the broad spectrum of the International Code Council (ICC) portfolio, which include the following:

- International Building Code
 - Educational Occupancies Requirement (schools and daycares)
 - Multifamily Buildings Requirement (R-2: apartment houses, congregate living facilities, etc.)
 - A non-mandatory provision for radon control in the body of the code
 - New Appendix—available for adoption by local and state jurisdictions
- Property Maintenance Code
 - Testing and mitigation requirement

The proposals for the various changes/additions to the ICC codes were submitted in January 2021 and then presented/defended at the Committee Action Hearings. Although all proposals were voted down (disapproved), support was shown by some members of the voting board. Next steps are a public comment period on the Committee’s ruling and a broader vote at the end of the year during the Public Comment Hearings. EPA is working with the stakeholder group formed for the code proposals to submit public comments based on feedback from ICC committee members.

Radon Credentialing

Professionals who provide radon testing and mitigation services play a key role in public health protection efforts. Although credentialing systems exist for radon professionals, and roughly 6,300 individuals are credentialed today in the United States through state licensure or private credentialing bodies, these systems lack a standard benchmark for quality. As part of EPA’s role to support state programs and promote the availability of the best possible radon services to consumers, EPA sought public feedback in 2017 on a proposed non-regulatory approach for developing a framework that would help align existing credentialing systems for radon service providers and promote access to a qualified workforce. The Agency plans to post an updated proposal online that reflects stakeholder feedback and hold an information session as soon as possible. For more information about EPA’s proposal, visit www.epa.gov/radon.

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Asthma

Asthma Awareness Month

The month of May provides EPA with increased opportunities to educate stakeholders on the seriousness of asthma and the 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 2021 National Environmental Leadership Award in Asthma Management winners in an effort to showcase and spread best practices from these programs. 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.

2021 National Environmental Leadership Award in Asthma Management

EPA honored two exceptional community-based asthma programs with the 2021 National Environmental Leadership Award in Asthma Management. EPA recognized the Central California Asthma Collaborative's (CCAC) Asthma Impact Model (AIM) Program and Rady Children's Hospital–San Diego (RCHSD) for their leadership in promoting environmental asthma management as part of comprehensive asthma care in the communities they serve.

CCAC's AIM Program is aimed at improving the lives of low-income, predominately Hispanic and African American Medi-Cal and uninsured patients suffering from asthma by reducing in-home environmental triggers, ensuring access to and proper use of asthma medications, and facilitating regular visits to health care providers. CCAC was established in 2011 to develop an in-home asthma program for children residing in low-income housing and communities of color. Over time, CCAC has partnered with health plans to receive direct patient referrals for high-risk asthmatic patients with high health care utilization. In response to COVID-19, CCAC has adapted the AIM Program to a virtual visit model to continue to provide participants with personalized asthma education and home remediation services. As a result of this work, asthma-related hospitalizations decreased by 70 percent, asthma-related emergency department usage decreased by 81 percent, and asthma-related outpatient visits decreased by 53 percent.

Rady Children's Health Network is a Clinically Integrated Network that combines primary care, specialty care and hospital-based services. For the past 5 years, RCHSD has implemented a Community Approach to Severe Asthma Program, an innovative initiative utilizing a community health worker (CHW) model with the goal of improving management and outcomes for children with severe asthma. CHWs contact the families of these children and perform in-home visits to conduct environmental assessments, reinforce health care provider instructions, assess asthma control, and set behavioral and environmental change goals. Due to COVID -19, the team moved the home visit program to a completely virtual format with great success. The program has seen up to a 75 percent reduction in emergency department return rates for both Medi-Cal patients and those with commercial insurance. RCHSD also is advocating with legislators in the state of California to drive expanded reimbursement for in-home environmental care services, specifically for Medi-Cal health plans.

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[AsthmaCommunityNetwork.org](https://www.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](https://www.asthmacommunitynetwork.org), an online resource that facilitates peer-to-peer engagement and action learning events. Currently, almost 4,700 members are 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!

AsthmaCommunityNetwork.org now features more schools-based content. Creating healthy indoor school environments is important to ensure that school-aged children, especially those with asthma, have healthy learning environments. To promote such environments, the Network has expanded to provide additional focus on addressing the school sector.

Comprehensive IAQ Interventions in Homes

Indoor airPLUS: New Homes

IED's Indoor airPLUS Program (IAP) continues to see impressive growth of IAP-labeled homes in 2021 and recently recorded the two highest quarters of IAP-labeled homes since the program's inception. The program also recorded 179 new Indoor airPLUS Partnership Agreements, including all of the regional divisions of Beazer Homes, the 15th largest corporate builder in the United States.

Indoor airPLUS: Version 2 Construction Specifications

In December of 2020, EPA's IAP released new proposed requirements for Version 2 of the *Indoor airPLUS Construction Specifications* for newly built homes. This will be the first significant set of changes to "raise the bar" for IAQ protections and additional measures to improve overall home performance and occupant comfort since the program was launched in 2008. Some of the areas proposed for advancement include requirements for balanced dwelling-unit ventilation, improved performance in HVAC design and filtration, lower envelope air leakage allowances, additional humidity control and local exhaust requirements, expanded requirements for radon-resistant construction, and additional categories for low-emitting materials.

The underlying strategies for risk-reduction in Version 2 are still the same, focusing largely on prescriptive measures to address source control, ventilation and filtration. However, EPA recognizes that the future of IAQ and healthier homes will begin to focus more on performance-based approaches that include IAQ sensors, monitors and connected systems. As these technologies advance, they will benefit both occupant awareness through the measurement and display of contaminants and occupant control of their indoor environment with more responsive and automated systems that improve ventilation and filtration on demand. Indoor airPLUS Version 2 begins to address some of these emerging areas of home performance, either through new requirements or as advisories that may become new specifications in the future.

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The first public comment period ended March 17. IED is now considering comments received and intends to initiate a second round of comments with a revised version of the specifications in late summer.

Indoor airPLUS: Leader Awards

From April 1 to June 8, IED's IAP accepted applications for the 2021 Indoor airPLUS Leader Awards. These awards recognize homebuilder and rater partners who construct and verify IAP homes designed and built for improved indoor air quality. The winners of the Indoor airPLUS Leader Awards will be publicly announced in August 2021 and will be formally presented at the Energy and Environmental Building Alliance High Performance Home Summit, September 14–16 in Denver, Colorado.

Indoor airPLUS: Web Content

The IAP continues to add web content to further illustrate the role of IAP as a comprehensive, whole-building system approach to a healthier home. Webpages include messaging on how IAP-labeled homes can help reduce exposure to airborne pollutants and such contaminants as viruses, bacteria, other pathogens, and wildfire smoke. This content is available at www.epa.gov/indoorairplus/indoor-airplus-and-viruses-bacteria-and-mold and www.epa.gov/indoorairplus/indoor-airplus-and-wildfires.

Energy Saving Plus Health Indoor Air Quality Guidelines for Single-Family and Multi-Family Housing

EPA has completed its update to the *Energy Saving Plus Health Indoor Air Quality Guidelines for Single-Family Renovations* (2011) and *Energy Saving Plus Health Indoor Air Quality Guidelines for Multifamily Renovations* (2016) housing to address IAQ concerns and technology advancements during energy upgrades. These voluntary guidelines provide best practices for improving IAQ in conjunction with energy upgrade work. The updates include references to building codes, industry standards and URLs; best practices and technical guidance; recent developments in pollutant control (e.g., particulate matter, radon, moisture); and general formatting for improved usability by industry stakeholders. The guidance will help users improve their IAQ and provide an opportunity to market improvements in existing homes. EPA has now released the documents and posted them to its website. The checklist generators that help aid users on specific projects to navigate through the documents will be released by the end of summer 2021.

Comprehensive IAQ Interventions in Schools

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

EPA continues to support healthy indoor environments in schools during the COVID-19 pandemic.

IED hosted two new webinars in the series [Healthy Indoor Environments in Schools: Plans, Practices and Principles for Maintaining Healthy Learning Environments](#).

- On April 8, IED hosted [Rooted in Research: Reducing Virus Transmission, Improving Ventilation and Promoting Healthy IAQ in Schools](#). The webinar highlighted layered risk-reduction strategies and IAQ

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management best practices for building operations to reduce the risk of virus exposure and promote healthy indoor air, which is foundational to student health, thinking and academic performance. Participants learned how to apply research-based guidance that reflects the latest scientific understanding of COVID-19 transmission in schools. Featured speakers were from the Harvard Healthy Buildings Program and the Florida State Plant Management Association.

- On May 6, IED hosted [Asthma-Friendly Schools: Strategies to Reduce the Risk of COVID-19 Transmission and Improve Indoor Air Quality](#). Participants learned how to utilize guidance and tools from CDC and EPA to choose safer disinfectants, effectively clean school facilities, and provide recommended ventilation and filtration to not only mitigate the risk of SARS-CoV-2 transmission but also create healthy learning environments for all students and staff, especially those with asthma. Featured speakers were health care providers from Children’s Mercy Hospital in Kansas City, Missouri, and an industrial hygienist who is the president and founder of Clean Health Environmental.

On April 27, IED moderated a webinar hosted by the Virginia School Plant Management Association, titled “Using Federal Funding to Create Lasting IAQ Infrastructure Improvements: Expert Panel Q&A.” Participants explored ways to develop plans and implement IAQ projects using Elementary and Secondary School Emergency Funding. During this webinar, an expert panel of IAQ researchers and practitioners shared their experience and expertise about the most effective ways to reduce virus transmission and improve IAQ in schools.

EPA continues promoting 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 to gain buy-in from the school community.

Upcoming Engagements

On June 30, the U.S. Department of Education and National Center on Safe Supportive Learning Environments is hosting a webinar in partnership with CDC and EPA on improving IAQ in schools. The webinar is part of the Department of Education’s [Lessons from the Field Webinar Series](#) that supports educational settings in safely sustaining or returning to in-person instruction. During this webinar, federal agencies will provide updates, and a panel of practitioners will discuss strategies they have utilized to improve indoor air quality and ventilation in response to the COVID-19 pandemic.

Expanding the Reach for School IAQ Training

EPA promotes IAQ guidance, tools and training to gain wider adoption of effective IAQ policies and practices in school districts across the country. EPA 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. EPA is eager to drive even more action in school districts through spreading the IAQ Master Class

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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 from among 20 topics, including mold, air cleaners, radon, environmental asthma and air quality in schools. Many topics are also presented in Spanish. Subscriptions can be cancelled easily at any time.

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