Federal Interagency Committee on Indoor Air Quality (CIAQ)
Meeting Minutes
March 11, 2020

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

Meeting Overview

- Welcome, Introductions and Announcements

- Federal CIAQ Member Agency Updates (Pages 3-25)

Federal Member Agency Project Spotlight

Topic:

An Assessment of Indoor Environmental Control Practices by Race/Ethnicity Among Children with Asthma In 14 US States and Puerto Rico, 2013-2014.

Presenter:

Ginger Chew, ScD, Health Scientist, Centers for Disease Control and Prevention (CDC) National Center for Environmental Health (NCEH)

Dr. Ginger L. Chew is the Deputy Associate Director for Science at CDC's Division of Environmental Health Science and Practice. She obtained her Masters in Industrial Hygiene at the University of Alabama- Birmingham (UAB), Doctorate of Science in Environmental Microbiology from Harvard School of Public Health, and completed post-doctoral studies in The Netherlands at Wageningen Universiteit.

Dr. Chew's research focuses on exposure assessment of aeroallergens and fungi in the indoor environment. She served as principal investigator on several epidemiologic studies of allergens and childhood asthma, particularly in inner-city environments. In addition to research projects, Dr. Chew is currently on the editorial board for *Indoor Air* and has served in the past as Associate Editor for *Aerobiologia*. She also served on an Institute of Medicine (IOM) panel on Climate change, the Indoor environment and Health.

IAQ Area of Interest Presentation

Topic:
Meta-Analysis of the Association of Respiratory Health Effects and Dampness and Mold in Schools
Presenter:
Wanyu Rengie Chan, Ph.D., Indoor Environment, Lawrence Berkeley National Laboratory

Dr Chan is the Deputy Co-Head of the Sustainable Energy & Environmental Systems Department. Her research interests include indoor air quality, building ventilation, and energy efficiency in residential and commercial buildings. Her research aims to generate knowledge to enable high performance, net zero energy use buildings that provide healthy and productive indoor environments. She led field studies to characterize indoor contaminant sources and evaluate energy efficient technologies to control occupant exposures. Dr. Chan earned her Ph.D. in Environmental Engineering from the University of California, Berkeley.

Post-Meeting Updates and Announcements

- The next CIAQ meeting is scheduled for June,2020.

U.S. Department of Energy (DOE)

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DOE, Department of Energy. (POC: Chris Early, chris.early@ee.doe.gov, 202-586-0514)
1. - Lawrence Berkeley National Laboratory Healthy Efficient Homes Research & Standards. POC Iain Walker (iswalker@lbl.gov) and Brett Singer (bcsinger@lbl.gov). This project will produce innovative technologies, industry guidance and codes and standards that reduce the energy cost of IAQ, and allow the building industry to achieve the energy savings in existing and new homes. This project also seeks to develop technologies to reduce the cost of implementing energy saving IAQ strategies. You can see more about this effort at this web page: https://energy.gov/eere/buildings/downloads/healthy-efficient-homes-research-standards. Some areas of research are:

- National New Home IAQ Study. Berkeley Lab is supporting the Building America program to develop and execute a national study of IAQ in new US homes.
- Kitchen Ventilation - Capture efficiency test method approved. Home Ventilating Institute approved the capture efficiency test method in Air Conditioning Heating and Refrigeration Institute Standard 920 (performance rating for air handling units.) (This builds from the ASTM test procedure that LBNL developed with DOE funds). Range hoods can now be lab tested for CE. Also, they passed Nominal Installed Airflow as a method for consistent ratings at realistic installed conditions. This solves a long standing contentious issue, and sets the stage for better transparency on fan performance, affecting sound and capture efficiency ratings.
- IAQ Score - The development of an IAQ Score similar to energy scores for homes, like the Home Energy Rating System Index, will enable homes with good IAQ to get credit for their better performance and will help establish a level playing field for valuation of IAQ by the housing industry.
- Smart Ventilation - The Smart Ventilation project is a multi-year lab project to develop control strategies and algorithms for residential ventilation systems. The objectives are to reduce the energy associated with ventilation by 40%, while maintaining equivalent Indoor Air Quality compared to typical ventilation systems without smart controls.
- Industry Standard Technical Support
- Some collaborating organizations are:
    - ASHRAE 62.2 (the standard for Ventilation and Acceptable Indoor Air Quality in residential buildings) committee,
    - Air Conditioning Contractors of America,
    - Building Performance Institute,
    - International Code Council,
    - Bonneville Power Administration,
      California Energy Commission ,
    - RESNET Standard 380 (Standard for Testing Airtightness of Building Enclosures, Airtightness of Heating and Cooling Air Distribution Systems, and Airflow of Mechanical Ventilation Systems)
    - American Council for an Energy Efficient Economy,
    - Energy Efficient Builders Association

1.1 LBNL attended the inaugural meeting of the *Indoor Environmental Quality Global Alliance* in Belgium in October 2019. The mission of IEQ-GA is to provide an acceptable indoor environmental quality (thermal environment-indoor air quality-lighting-acoustic) to occupants in buildings and places of work around the

world and to make sure the knowledge from research on IEQ get to be implemented in practice. https://ieq-ga.net/.

Members are:

1. the American Conference of Governmental Industrial Hygienists (ACGIH®)
2. AiCARR (Associazione Italiana Condizionemento dell'Aria, Riscaldamento e Refrigerazione)
3. the American Industrial Hygiene Association (AIHA)
4. the Air Infiltration and Ventilation Centre (AIVC)
5. the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
6. the Indian Society of Heating, Refrigerating and Air Conditioning Engineers (ISHRAE)
7. the Federation of European Heating, Ventilation and Air Conditioning Associations (REHVA)

1.6.1- Lawrence Berkeley National Laboratory New Reports and Journal Articles.
"Improving Indoor Air Quality During Wildfires". Informal web page news article Q&A with Berkeley Lab indoor air scientists on protecting homes, schools, and other buildings, from air pollution during wildfires. By Jessica Scully. October 25, 2019. https://newscenter.lbl.gov/2019/10/25/improving-indoor-air-quality-during-wildfires/

"Assessment of occupant-behavior-based indoor air quality and its impacts on human exposure risk: A case study based on the wildfires in Northern California." *Science of The Total Environment* 686 (2019). Luo, Na, Wenguo Weng, Xiaoyu Xu, Tianzhen Hong, Ming Fu, and Kaiyu Sun. LBNL and China. https://eta-publications.lbl.gov/sites/default/files/assessment_of_occupant-behavior-based_indoor_air_quality_and_its_impacts_on_human_exposure_risk.pdf This work aims at addressing existing knowledge gaps in understanding how indoor air quality is affected by outdoor air pollutants during wildfires—by taking into account occupant behaviors (e.g., movement, operation of windows and air-conditioning) which strongly influence building performance and occupant comfort. A novel modeling framework was developed to simulate the indoor exposure risks considering the impact of occupant behaviours by integrating building energy and occupant behaviour modeling with computational fluid dynamics simulation.

"Evaluation of short-term initial performance of a "Molekule Air" portable air cleaner." Xiaochen Tang and Hugo Destaillats. January 2020. DOE Office of Science. https://eta-publications.lbl.gov/sites/default/files/lbnl-2001260_-_molekule_air_purifier_-_final.pdf.
In experiments where a challenge VOC mixture was injected, the concentrations of all pollutants introduced to the chamber were significantly reduced in periods in which the air cleaner was operated, with a 95% removal efficiency for limonene, 94% for toluene and 55% for formaldehyde. In separate experiments, the removal efficiency for ozone was 95%. No formation of byproducts was observed with the analytical methods used in this study.

"Ventilation rates in California classrooms: Why many recent HVAC retrofits are not delivering sufficient ventilation." *Building and Environment* 167. January 2020. Chan, Wanyu R, Xiwang Li, Brett C Singer, Theresa Pistochini, David Vernon, Sarah Outcault, Angela Sanguinetti, and Mark Modera. https://eta-publications.lbl.gov/sites/default/files/ventilation_rates_in_california_classrooms-_why_many_recent_hvac_retrofits.pdf

Previous research has shown that under-ventilation of classrooms is common and negatively impacts student health and learning. To advance understanding of contributing factors, this study visited 104 classrooms from 11 schools that had recently been retrofitted with new heating, ventilation, and air-conditioning (HVAC) units. CO2 concentration, room and supply air temperature and relative humidity, and door opening were measured for four weeks in each classroom. Field inspections identified HVAC equipment, fan control, and/or filter maintenance problems in 51% of the studied classrooms.

Classrooms with economizers, with or without demand control ventilation, tended to have lower mean CO2. Improperly selected equipment, lack of commissioning, incorrect fan control settings and maintenance issues (heavily loaded filters) were all associated with under-ventilation in classrooms. Many classrooms in this sample were frequently too warm to support learning. There were 23 out of 103 classrooms that had indoor air temperature above 25.6 degrees C for more than 20% of the school hours. Better oversight on HVAC system installation and commissioning are needed to ensure adequate classroom ventilation. Periodic testing of ventilation systems and/or continuous real-time CO2 monitoring (either as stand-alone monitors or incorporated into thermostats) is recommended to detect and correct ventilation problems.

1.2 - Argonne National Laboratory area of research.

The *Waggle Platform* is a research project at Argonne National Laboratory to design, develop, and deploy a novel wireless sensor platform with advanced edge computing capabilities to enable a new breed of sensor-driven environmental science and smart city research. Their web site is: https://wa8.gl/ The software and hardware designs from the Waggle project are used by the Array Of Things project, which is building a smart city and open data with urban sensors in Chicago. The innovative architecture leverages emerging technology in low-power processors, sensors, and cloud computing to build powerful and reliable sensor nodes that can actively analyze and respond to data. Cloud computing provides elastic resources for storing and computing on data. All of the software is Open Source, and the software is modular, so researchers can add their own sensors, computing pipelines, and data analysis.

Consumer Product Safety Commission (CPSC)

Agency POC, Charles Bevington, 301-987-2009, cbevington@cpsc.gov and John Gordon, 301.987.2025, jgordon@cpsc.gov)

Nano materials: (POC Joanna Matheson, 301.987.2564, jmatheson@cpsc.gov).
Work continues with the University of Florida and the University of Cincinnati. Projects scheduled for completion this fiscal year include the University of Cincinnati's literature review (of articles published in 2016-2019) to fill data gaps and determine the appropriate dose metrics for *in vivo* and *in vitro* studies for nano silver, nano titanium dioxide, and carbon nanotubes. In addition, the final report from the University of Cincinnati on a literature review of the emerging nanomaterials nano alumina, nano cellulose, and graphene is expected by September 2020. The University of Cincinnati continues to work on a literature review on the applications and uses of Fire-Retardant (FR) nanomaterials in consumer products and the potential for consumer exposure. The University of Florida's international collaboration with EU institutions and the Lawrence Berkeley National Laboratory on the "NanoWIR2ES: NanoWire intelligent re-design and recycling for environmental safety" project is scheduled for completion this fiscal year. The researchers in the consortium have investigated the release of silver nanowires from touchscreen displays, the toxicity of the silver nanowires to human and ecosystem health, and the mechanisms by which silver nanowires induce toxicity. Some of this work appears in a recent publication (Lehmann et al., 2019. Crumpling of silver nanowires by endolysosomes strongly reduces toxicity. Proceedings of the National Academy of Sciences 116 (30): 14893-14898). We continue to work on projects with NIOSH, EPA and NIST:

- NIOSH is:
  - Continuing a multiyear project assessing toxicological responses to aerosolized emissions from Fused Deposition Modeling (FDM) 3D printers.
    - The Phase 1 study consisted of characterizing emissions from ABS, PLA, and polycarbonate filaments with and without multi-walled carbon nanotubes (MWCNTs); design and construction of a 3-D printer exposure system for *in vitro* and *in vivo* exposure studies; and, performance of the *in* vitro studies. Farcas et al., 2019. Acrylonitrile butadiene styrene (ABS) and polycarbonate (PC) filaments three-dimensional (3-D) printer emissions-induced cell toxicity. Toxicology Letters 317: 1-12.
  - The Phase 2 studies are continuing with a focus on characterizing emissions from ABS and PLA filaments with other types of engineered nanoparticles (other than MWCNTs); developing a high-throughput emission generation method for toxicology studies, optimized for inhalation exposure; investigating pulmonary and microvascular responses, liver toxicity, neurotoxicity, as well as the biodistribution and biopersistence of emissions, after inhalation of PC filament emissions in rats; evaluating responses in a murine experimental model of asthma; and, evaluating the toxicological effects on the reproductive system after exposure to PC filament emissions

in vitro using commercially available human placental cells. CPSC staff is initiating a project in collaboration with the EPA that evaluates several 3-D printers during operation and during feedstock recycling tasks to understand factors that influence release of emissions. Specifically, the aims of this project are to evaluate the influence of Fused Filament Fabrication (FFF) 3-D printer design, FFF feedstock filament; and recycling plastics to make filament and FFF 3-D printing with recycled filaments.

- EPA is:
  - Continuing a multi-year collaborative project with NIOSH on characterizing commercially available and commonly purchased FDM filament materials, quantifying the composition and release of organic and inorganic chemicals and materials from FDM printer filaments, waste, and printed objects.
    - The Phase 1 work involved compositional characterization of commercially available FDM filament materials; the compositional characterization of particulate and gaseous/aerosol elements released during the FDM printing process (e.g., identifying the size distribution, agglomeration, chemical content, metal content, nanoparticles/nanotube content; identifying VOCs and SVOCs and emission rates); and, the accumulation and composition of particulate matter in areas adjacent to the FDM printer during and after operation will also be assessed.
    - The Phase 2 studies continue, including identification of post-print processing procedures for various FDM filament materials; compositional characterization of products and/or waste materials created from the printing process as well as substances released from printed products and post-print modified products under relevant and intended use conditions for the product lifecycle; and, the determination of product fragility under foreseeable use scenarios.
- NIST continues its projects on:
  - Developing a bioassay validation program.
  - Performing a long-term (multi-week) release, accumulation and continuous monitoring study using multiple consumer-grade 3D printers to support downstream exposure assessment.

Portable generator safety: (POC Janet Buyer, 301.987.2293, jbuyer@cpsc.gov).

New Updates:

No new updates from the last update (delivered (October 2019). We continue to work on the projects with a plan for evaluating the effectiveness of PGMA and UL voluntary standards.

Previous Update: (October 2019)

Nov 2016, the U.S. CPSC voted to approve a notice of proposed rulemaking (NPR) to reduce the risk of carbon monoxide (CO) poisoning deaths and injuries associated with portable generators.

- The proposed rule limits portable generators' CO emission rates.
- The proposed rule's CO emission rates, which are technically achievable using existing and proven emission control technologies that are already in the marketplace, are expected to lower the CO emission rate from that of current generators by nominally 90%.

- The Federal Register notice with information about the proposed rule is available here: https://www.federalregister.gov/documents/2016/11/21/2016-26962/safety-standard-for-portable-generators.
- The comment period closed April 24, 2017.
- The comments can be viewed by going to www.regulations.gov , and typing CPSC-2006-0057 on the search line.

Staff has also been participating in development of voluntary standards to address the hazard.

- On 1/24/2018, Underwriters Laboratories (UL) announced that UL 2201 has received ANSI approval https://www.ul.com/portablegenerators
    - This standard has a requirement for
        - reduced CO emission rate of 150 g/hr
    - shut off when the CO concentrations around the generator reach either of the following at a location 1 foot above the approximate center of the top surface of the portable generator:
        - instantaneous reading of 400 ppm
        - Rolling 10-minute average of 150 ppm

- On 4/20/2018, in a separate voluntary standard by the Portable Generator Manufacturers Association (PGMA), G300 standard, *Safety and Performance of Portable Generators*, also received ANSI approval.
    - This standard has a requirement for a CO sensing shutoff system that will shut the generator off when CO concentrations around the generator reach either of the following at a location 1"-2" above the approximate center of the top surface of the portable generator:
        - instantaneous reading of 800 ppm
        - Rolling 10-minute average of 400 ppm

Staff has an interagency agreement with NIST to estimate the effectiveness of the CO hazard mitigation requirements in these standards. The plan for this evaluation is published in NIST TN 2048 (available online at http://dx.doi.org/10.6028/NIST.TN.2048). It was open for public comment from July 9 to Sept 9, 2019. CPSC and NIST are evaluating the comments and will revise the plan as appropriate before executing the plan. An additional report was published the same time as the plan, NIST TN 2049 (available online at http://dx.doi.org/10.6028/NIST.TN.2049). This report documents testing that was done on generators that were shut off using the shutoff criteria in both voluntary standards.

ASTM D22 Indoor Air Sub-committee Spray Polyurethane Foam (SPF) activities: (POC Charles Bevington, 301.987.2009, cbevington@cpsc.gov and Adrienne Layton, 301.987.2590, alayton@cpsc.gov).

New Update: (March 2020)
CPSC staff issued a fact sheet titled Spray Polyurethane Foam Insulation: Health and Safety Recommendations for Consumers.
https://www.cpsc.gov/s3fs-public/Spray-Polyurethane-Foam-Insulation-Health-and-Safety-Recommendations-for-Consumers_0.pdf?QPRrrHlXYHw6GSqpG7Gm5NMIUGKUi0B1

We continue to work on the projects with ASTM, and will deliver these reports when they are ready for release.

Previous Update: (October 2019)
ASTM Air Quality/Indoor Air (D22.05) subcommittee, CPSC has been involved in providing technical support for the development of voluntary standards to test for chemical emissions from SPF insulation and other products:

- **WK61814** Practice for Full- Scale Chamber Determination of Volatile Organic Emissions from Indoor Materials/Products
- **WK58354** New Standard Measuring Chemical Emissions from Spray Polyurethane Foam (SPF) Insulation Samples in a Large-Scale Spray Room
- **WK58356** New Standard Conducting emission and fate modeling for Spray Polyurethane Foam (SPF) insulation in an indoor environment
- **D7297-2014** Practice for Evaluating Residential Indoor Air Quality Concerns
- **WK28325** New Standard Estimating Inhalation Exposure Concentrations in Low-rise Residential Buildings Resulting from Volatile Organic Compounds Emitted by New Building Products and Furnishings and from Use of Consumer Products

An interagency agreement (IAG) was completed with NIST to conduct chamber testing of SPF samples.

- The IAG has helped to develop methods that will characterize and quantify releases of amines and other compounds to aid in ASTM standard development. The final report is on the NIST website: NIST Technical Report 1921. https://nvlpubs.nist.gov/nistpubs/TechnicalNotes/NIST.TN.1921.pdf

Mold Projects: (POC Eric Hooker, 301-987-2516, ehooker@cpsc.gov).

New Update:
No new updates from the last update (delivered October 2019). We continue to work on these projects, and will deliver these reports when they are ready for release.

Previous Update: (October 2019)
CPSC contracted with TERA to perform a review on the health risks of common mold species likely to be found in and around the home.

- Two reports, "Review of the Health Risks of Mold, Basic Mold Characteristics" and "Review of the Health Risk of Mold, Health Effects of Molds and Mycotoxins" can be found online at: https://www.cpsc.gov/Research--Statistics/Chemicals/.
- Those reports were used by TERA to develop a tool, a dashboard to perform a preliminary hazard assessment on mold. The Mold Tool was delivered to CPSC in September 2017.
    - The Mold Tool is intended to be used during an interview with a consumer who is complaining about a product that developed mold.
    - The Mold Tool guides the interviewer in detailed questions about mold incidents and stores the responses in a database that can be mined to identify trends in mold occurrences.
    - The tool also has a feature meant to identify a possible mold genus through a series of questions about the appearance and growth conditions of the mold.
- CPSC staff is considering a project to have the Mold Tool peer reviewed and to contract a programmer to fix the bugs and improve usability.
- Staff is considering options for putting the mold identification feature of the Mold Tool on the CPSC's public website.

Emerging Technologies/3D Printers/Wearable Technology (Sensors): (POC Treye Thomas 301.987.2560, tthomas@cpsc.gov).

New Update: There are a couple of short updates since the last update (delivered (October 2019). CPSC staff is working on a report on 3D printer activities, and may be released soon. CPSC staff are seeking to increase participation in voluntary standards activities in this area through outreach letters to standards development organizations.

Wearable and Sensors – CPSC staff continues work on wearable technology. Wearables include a wide range of products that includes sensor technologies that may characterize chemical exposures in the indoor environment. We are anxious to learn more about other agencies developing or testing devices that may be used to measure chemical and particulate levels in the home environment. There are questions regarding the reliability of these devices and how consumers can calibrate and maintain accuracy.

Previous Update: (October 2019)
We continue to work on the projects with 3D printers, and will deliver these reports when they are ready for release.

CPSC met with NIOSH, EPA, and FDA on August 20, 2019, regarding 3D printers.

The beta version of an exposure tool titled Engineered Nanoparticle Airborne Exposure Tool is available. This tool was developed through an interagency agreement with NIST and is based on the NIST CONTAM model. This exposure tool will predict exposure over time based on source strength.
Link: https://pages.nist.gov/CONTAM-apps/webapps/NanoParticleTool/index.htm

CPSC Staff is interested in consumer 3D printing and potential air contaminant (VOC and particle) release.

- Previously, Staff has reviewed publications with 3D printer emission data and estimated preliminary risk from exposure to emitted VOCs in order to determine potential health and safety issues to consumers (SOT poster).
- CPSC student interns have investigated potential risks associated with 3D printing in primary schools.
- Staff has also joined the ASTM F42.06/ISO TC261 Additive Manufacturing workgroup
    - This group is primarily working on definitions and terminology
- Staff is working with EPA and NIOSH to conduct studies on the composition of materials in 3D printer filament and the release of various compounds, including VOCs, during printing (see above under Nano)

Center for Disease Control (CDC)

National Center for Environmental Health (NCEH)
Division of Environmental Health Science and Practice
Asthma and Community Health Branch

- CDC's Asthma and Community Health Branch (ACHB) has worked with the Department of Housing and Urban Development's (HUD) Office of Lead Hazard Control & Healthy Homes and with the Environmental Protection Agency's (EPA) Indoor Environments Division to co-brand evidence-based home assessment training with a focus on asthma triggers. These training slides will be used with the already co-branded Home Assessment Checklist published in June 2018 (https://www.cdc.gov/asthma/pdfs/home_assess_checklist_P.pdf). This coordinated approach and co-branding of a single training slide set reduces duplication of efforts across agencies and simplifies procedures for workers in the field. This home visitor training is for users of the co-branded Home Assessment Checklist. The training slides are in the final stages of editorial review and should be ready for distribution in Spring 2020.
- Hurricane Supplemental Project 3-3: Children with Asthma: Post Hurricane Burden and Risk Factors funds 4 jurisdictions to assess the impact of Hurricanes Harvey/Irma/Maria on children with asthma. As part of this project survey data is being collected on post-hurricane indoor environmental exposures such as mold.
- Analysis of BRFSS Asthma Call-back Survey 2014-2016 data to examine asthma control and indoor environmental exposures among children and adults in Puerto Rico. This analysis is being conducted in collaboration with the Puerto Rico Department of Health.
- Systematic review on the impact of hurricanes on children with asthma is being conducted. This review will the review of studies that examined the association between post-hurricane mold exposure and childhood asthma.
- Recent publication: Rozwadowski FM, Chew GL, Zahran HS, and ML Santorelli. Assessing Indoor Environmental Control Practices by Race/Ethnicity Among Children with Asthma in 14 US States and Puerto Rico, 2013-2014. *Prev. Chronic Dis*., 2019.

Water, Food, and Environmental Health Services Branch
CDC's National Center for Environmental Health leads the environmental health component of CDC's Legionnaires' disease prevention and outbreak response. As part of this program, CDC funds 37 state, local, tribal, and territorial health departments to improve prevention and response practices for Legionnaires' disease outbreaks. Our group routinely provides consultative service on Legionnaires' disease as it relates to indoor air quality impacted by the built environment – for example, exposures from hot tubs, cooling towers, and decorative fountains in which *Legionella* bacteria are aerosolized from water and can be breathed in. As water management programs can reduce a building's risk for growing and spreading *Legionella*, we also provide training and

technical assistance to support the use of water management programs. Examples of our activities include:

- In November 2019, CDC released a Health Advisory alerting environmental and public health officials about a new exposure risk for Legionnaires disease: hot tub displays at temporary events. The advisory provided guidance on how to minimize risk at these temporary events (e.g., fairs, home and garden shows, conventions).
- This was in response to an outbreak of Legionnaires' disease associated with a state fair in September 2019. By November there were 139 confirmed cases (134 Legionnaires' disease and 5 Pontiac fever), resulting in 96 hospitalizations and 4 deaths. The investigation (conducted by North Carolina Department of Health and Human Services) suggested exposure to *Legionella* bacteria occurred in an events center building where vendors were displaying hot tubs.

Division of Laboratory Sciences

Microbial volatile organic compounds (MVOCs) are produced in the metabolism of micro-organisms such as fungi and bacteria. They are formed during both the primary metabolism (from the synthesis of DNA and amino and fatty acids, for example) and the secondary metabolism (from intermediates of the primary metabolism) as side-products, mainly in the metabolic oxidation of glucose from various intermediates. Thus, the production of MVOCs is greatly affected by microbial species, growth phase and conditions such as nutrients, pH, humidity, and temperature. More than 200 compounds are regarded as MVOCs in the literature. The compounds also have other environmental sources besides microbial metabolism. Concern about possible health risks related to MVOC exposure in indoor environments was also raised in the 1990s. Current activities include:

- The Volatile Organic Compounds Laboratory, Division of Laboratory Sciences, National Center for Environmental Health, is developing a method to quantify five microbial volatile organic compounds in human serum: 1-octen-3-ol, 2-ethyl-1-hexanol, 3-methylfuran, 3-octanone, and geosmin.
- Upon successful validation, we will use this method to analyze samples obtained during the Green Housing Study, in collaboration with Dr. Ginger Chew. The results will be analyzed to examine potential human exposure to MVOCs in moldy environments.

National Center for Emerging and Zoonotic Infectious Diseases (NCEZID)

Mycotic Disease Branch

Flooding from Hurricane Harvey caused extensive indoor mold growth, and exposures to high levels of indoor mold may increase the risk of life-threatening invasive mold infections (e.g., aspergillosis, mucormycosis) in people with weakened immune systems. To prevent illness, federal agencies recommend that people with weakened immune systems not take part in cleanup of mold-damaged homes, but the degree to which pathogenic fungi are present in flood-damaged homes is unclear, since most molds do not cause invasive infections. Current assessments include:

- The CDC Mycotic Diseases Branch and NIOSH are working the Texas Department of State Health Services, the City of Houston Health Department, and Harris County Public Health to test floor dust samples collected from flooded 150 households with or without remediation and non-flooded households for the presence and quantity of pathogenic molds to inform risk communication to populations at greater risk of infection.
- Dust samples are being collected from the living room and the most damaged room by flooding for each of the sampling households, and status of water damage for these sampled rooms is being evaluated using NIOSH Dampness and Mold Assessment Tool form published in 2019.

National Institute for Occupational Safety and Health (NIOSH)

Health Effect Laboratory Division

- The first NTP toxicological assessment that evaluated the fungal species, *Aspergillus fumigatus* has been completed and the report has been drafted. The final report should be finalized and published by the NTP in 2020.
- A murine inhalation study of repeated *Stachybotrys chartarum* exposure that was funded through an Interagency Agreement between NTP-NIEHS and NIOSH was published in Am J Respir Cell Mol Biol. The study characterized the mechanisms that influenced pulmonary immune responses to B6C3F1/N mice repeatedly exposed to *S. chartarum* via nose-only inhalation. Two strains of *S. chartarum* were evaluated and mice were exposed twice a week for 4 and 13 weeks. Strain A was found to produce higher amounts of respirable fragments compared to Strain B. Evaluation of BALF from Strain A-exposed mice showed an influx of inflammatory cell populations as early as 4 weeks, compared to 13 weeks in the BALF from Strain B-exposed mice. Gene expression profiling at 4 weeks post-exposure resulted in a Th2-mediated response and after 13 weeks, a mixed T-cell response was observed following exposure to Strain A, compared to a Th2-mediated response following Strain B exposure. Interestingly, both strains induced pulmonary arterial remodeling leading to pulmonary hyperplasia at 13 weeks; however, Strain A-exposed mice progressed more quickly compared to Strain B-exposed mice. Both the immune response and the observed pulmonary arterial remodeling were supported by specific cellular, molecular, and proteomic profiles. This study that utilized a unique nose-only inhalation exposure system showed that the induction of pulmonary hyperplasia by *S. chartarum* appears to be related to the presence of fungal fragments during exposure.

Division of Field Studies and Engineering

- The NIOSH Workplace Solution document “Maintaining Acceptable Indoor Environmental Quality (IEQ) During Construction and Renovation Projects” has been completed and posted on the web (https://www.cdc.gov/niosh/docs/wp-solutions/2020-110/default.html). It is a summary of some of the issues and solutions that can occur during renovation in an occupied building.

Respiratory Health Division

- In the collaborative study with CDC/NCEZID, Environmental Microbiology Laboratory in the Respiratory Health Division started to receive dust samples collected from the households affected by Hurricane Harvey and the control households in Houston area, TX. The dust samples will be processed and made into aliquots for various analyses of microbial agents including pathogenic fungi.
- An international collaborative study of elementary schools in South Korea to evaluate effectiveness of the use of air cleaners in classrooms was conducted and the results have been published. The study found that school location, classroom occupant density, and ambient PM levels significantly (p-values<0.05) affected classroom PM concentrations. And the adjusted PM levels in classrooms using air cleaners were significantly (p-values<0.01) lower by approximately

  35% than in classrooms not using them. Air cleaners removed $PM_{2.5}$ more effectively than PM_{10}. The article can be found on the web (https://doi.org/10.1016/j.buildenv.2019.106437).
- A laboratory study to evaluate effects of storage time and temperature condition on concentrations of fungal secondary metabolites including mycotoxins has been conducted and a manuscript ("Effect of Storage Temperature and Duration on Concentrations of 27 Fungal Secondary Metabolites Spiked into Floor Dust from an Office Building) has been accepted in the Journal of Occupational and Environmental Hygiene. In the study, floor dust samples were spiked with 27 fungal secondary metabolites and then stored at room temperature, 4°C, and -80°C for up to 2 years. The study found that spiked concentrations of the metabolites, including mycotoxins, were generally declined faster at room temperature than at 4°C and -80°C. The study findings indicate potential decomposition of the metabolites including mycotoxins in indoor environments after they are released from fungi. The electronic version of the manuscript will soon be available.

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: http://www.youtube.com/watch?v=xSzu83fyQaQ. All publications can be found at the NIST NZERTF web page http://www.nist.gov/el/nzertf/. Studies on thermal performance of the small duct, high velocity distribution system as compared to a conventional air-to-air heat pump have been completed in collaboration with Dr. Hyojin Kim at The Catholic University of America. The report is available at https://doi.org/10.6028/NIST.GCR.19-021. Presentations have been accepted to Indoor Air 2020 to be held in Seoul, Korea from July 20-24. A tracer gas system that measures both SF_6 and CO_2 has been installed in the home in order to obtain continuous air change rate measurements and conduct CO_2 injections for investigation of demand-controlled ventilation and other control approaches. A CO_2 heat pump water heater has been installed, and a CO_2 geothermal heat pump will be installed later this year. Contact: Lisa Ng, 301-975-4853, lisa.ng@nist.gov.

Cigarette Butt Emissions: Globally, around five trillion cigarette butts are disposed of per year. FDA has regulatory authority over cigarettes and associated waste and is pursuing an environmental impact analysis of cigarette butts. In support of that effort, FDA funded an interagency agreement with NIST to conduct an investigation into airborne emission of non-smoldering cigarette butts. The FDA-funded effort examined over 1,600 butts to determine 1) the initial distributions of emitted target chemicals in the cigarette butt, and 2) the influence of environmental parameters (temperature, relative humidity, aqueous saturation, UV, and airflow rate) on airborne emissions. Further work examining 500 butts (funded by NIST) was done to determine airborne emission rates for target chemicals from cigarette butts in a simulated indoor environment. Both efforts demonstrated non-smouldering butts can be a significant source of airborne chemicals, including nicotine. Summaries of this work can be found in Indoor Air (https://doi.org/10.1111/ina.12648), Science of the Total Environment (https://doi.org/10.1016/j.scitotenv.2019.136422) and a report to FDA (https://doi.org/10.6028/NIST.IR.8256). Contact: Dustin Poppendieck, 301-975-8423, dustin.poppendieck@nist.gov.

Coupled IAQ and Energy Analysis in Multi-family Buildings: NIST continues to improve upon previously developed co-simulation capabilities between CONTAM and EnergyPlus. NIST is collaborating with several organizations to apply co-simulation to address various aspects of the interaction between energy, airflow and IAQ in both residential and commercial buildings.

Researchers at the Boston University School of Public Health have collaborated with NIST to implement this co-simulation capability to address the IAQ and energy use associated with building retrofits and their effect on occupant health, building energy usage and resulting economic impacts. Multiple analyses were performed as part of this collaboration to address indoor and outdoor sources of particulates.

In one study, it was found that combined weatherization and improved ventilation recommended by design standards could lead to both energy savings and IAQ-related benefits; however, ventilation standards may not be sufficient to protect against IAQ disbenefits for residents exposed to strong indoor sources. In another study, health impacts were monetized using health impact assessment techniques and compared to retrofit-related savings. For a modeled gas-heated midrise multifamily building in Boston, MA, weatherization

retrofits without ventilation or filtration retrofits led to household health costs that far exceeded energy savings and population-level health savings, given increases in indoor PM2.5 concentrations (3.1 µg/m^3 and 20.4 µg/m^3 for standard and high-performance retrofits, respectively). In contrast, weatherization coupled with ventilation and filtration retrofits resulted in large savings. A third study evaluated the impact of regional weather on residential energy consumption and IAQ due to energy-related retrofits. Overall, these studies reinforce the need to quantify residential health impacts in assessments of energy-efficient retrofits.

NIST has also been working with researchers at the Norwegian University of Science and Technology to apply co-simulation to evaluate energy and IAQ related performance of CO_2-based demand controlled ventilation in commercial buildings in Norway. The conference paper cited below presents the results of an initial study of the effects of recirculation rates on energy use and various pollutant levels within a portion of an office building.

The final paper cited presents an overview of the cross-platform co-simulation software and its application to performing parametric analysis for combined energy, airflow and IAQ in a midrise apartment building.

Underhill, L. J., C. W. Milando, J. I. Levy, W. S. Dols, S. K. Lee and M. P. Fabian (2020). *Simulation of indoor and outdoor air quality and health impacts following installation of energy-efficient retrofits in a multifamily housing unit*. Building and Environment **170**: 106507.

Underhill, L. J., W. S. Dols, S. K. Lee, M. P. Fabian and J. I. Levy (2020). *Quantifying the impact of housing interventions on indoor air quality and energy consumption using coupled simulation models*. Journal of Exposure Science & Environmental Epidemiology.

Connolly C., Milando C., Dols W., Levy J. Fabian M. *The impact of regional weather on residential energy consumption and indoor air quality changes due to energy retrofits*. ISES-ISIAQ 2019 Conference. Kuanas, Lithuania.

Alonso, M. J., W. S. Dols and H. M. Mathisen (2019). *Using co-simulation between EnergyPlus and CONTAM to develop IAQ and energy-centric demand-controlled ventilation systems*. 40th AIVC - 8th TightVent - 6th venticool Conference. Ghent, Belgium.

Dols, W. S. and L. J. Underhill (2018). *Cross-platform, Public Domain Simulation Tools for Performing Parametric IAQ and Energy Analysis*. 7th International Building Physics Conference. Syracuse, NY.

ASHRAE Standard 62.2

The committee responsible for Standard 62.2 on residential ventilation and IAQ will meet in June in Austin to continue working on proposed changes that may be included in the 2022 version of the standard. Topics being addressed include changes to multifamily housing requirements, kitchen hood capture efficiency, garage ventilation and an IAQ equivalency option. Contact: Steven Emmerich, 301 975-6459, steven.emmerich@nist.gov.

ASHRAE Position Documents

The Indoor Air Quality Position Document Committee has met several times this year as they continue to work on updating that document. The new version of the Position Document is expected to be published later in 2020. Contact: Andrew Persily, 301 975-6418, andyp@nist.gov.

ASHRAE has initiated a revision of its Position Document on Environmental Tobacco Smoke, which is expected to be approved and published in 2020. Contact: Andrew Persily, 301-975-6418, andyp@nist.gov.

ASHRAE initiated a new Position Document on Indoor Carbon Dioxide, which will be drafted this year and approved late this year or in early 2021. Contact: Andrew Persily, 301-975-6418, andyp@nist.gov.

ASHRAE has approved a new Position Document on Resiliency in the Built Environment in June 2019. The position document can be downloaded at: https://www.ashrae.org/about/position-documents. Contact: Andrew Persily, 301-975-6418, andyp@nist.gov.

ASHRAE Standard 189.1

The 2017 version of ASHRAE/ICC/IESUSGBC SSPC 189.1, Standard for High-Performance Green Buildings Except Low-Rise Residential Buildings, was approved for publication late last year and includes 75 individual revisions to the 2014 version. The standard constitutes the technical content of the 2018 International Green Construction Code, which was just published late in 2018 and is available from the International Code Council and ASHRAE. Standard 189.1-2017 itself will only be available outside of the U.S. and Canada per an agreement between AIA, ASHRAE, ICC, IES and USGBC. In the area of indoor environmental quality, revisions that have been incorporated into the 2017 standard (and therefore the 2018 IgCC) include a restriction on the indoor use of unvented combustion devices, a requirement for occupant surveys to assess satisfaction with indoor environmental quality, and improvements to lighting quality through daylighting and glare control.

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 https://www.ashrae.org/resources--publications/free-resources/listserves. Contact: Andrew Persily, 301-975-6418, 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 IEQ and Water Efficiency chapters. To participate in the revisions, please contact: Lisa Ng, 301-975-4853, lisa.ng@nist.gov or Tania Ullah, 301-975-8410, tania.ullah@nist.gov.

ASTM: D22.05 Subcommittee on Indoor Air

The subcommittee has several efforts underway. Efforts continue to test a draft of WK62732 (New Standard Performance Evaluation of Consumer-Grade Indoor Air Quality Sensors and Sensing Devices) for carbon dioxide and PM2.5 sensors. This work will likely start the ballot process in 2020. Existing standards are continually undergoing review and revision on a 5-year rotation. Since the last meeting a survey of D22.05 members gauged interest for ideas for new standard methods and guides. One effort has already started, a working group has begun to draft a Standard Guide for Measurement Techniques for Formaldehyde in Indoor Air (WK71196).

At the next meeting in Boston on March 31st, 2020 there will be time set aside to other future standard needs of the communities the committee serves (industry, regulatory agencies, equipment manufacturers, testing labs and the public). Feel free to give input on your needs by joining or contacting a committee member. Contact: Dustin Poppendieck, 301-975-8423, dustin.popendieck@nist.gov.

U.S. Department of Housing and Urban Development (HUD)

HUD Office of Lead Hazard Control and Healthy Homes (OLHCHH)

1) Healthy Homes and Weatherization Program Coordination Grants
In Fiscal Year 2020 HUD OLHCHH will publish a new Notice of Funding Availability (NOFA) announcing $5 million in funding to promote coordination between local HUD-funded Lead Hazard Control/Healthy Homes program grantees and Department of Energy-funded Weatherization Assistance Programs. The funds will be awarded in up to five communities with both programs to determine whether coordination between the two programs can result in cost savings and better outcomes to households receiving the combined services.
HUD Contact: Brenda Reyes, MD, MPH (brenda.m.reyes@hud.gov)

2) Recently Completed Research
The following is a synopsis of HUD-funded IEQ research that has been recently completed. For all examples, papers have been submitted for publication: **1) Eastern Virginia Medical School**: evaluation of implementation of a smoke-free housing policy in public housing in Norfolk, VA (included measurement of $PM_{2.5}$ and nicotine in common areas) (Principal Investigator (PI): Andrew Plunk, PhD); **2) San Diego State University**: distribution of tobacco residue (thirdhand smoke) in low income multifamily housing and assessment of the efficacy of cleaning methods (PI: Georg Matt, PhD); **3) University of Cincinnati**: evaluated the relationship between measured surface areas of water damage and mold growth in homes of children at high risk for developing asthma at age 1 and respiratory health at ages 3 and 7 (PI: Dr. Tiina Reponen), and **4) University of Tulsa**: analysis of mold in house dust of water damaged and non-water damaged homes using DNA-based methods with subsequent data analysis using artificial intelligence to determine fungal distribution patterns and potential value for using fungal signatures to identify homes with mold/moisture problems (PI: Richard Shaughnessy, PhD).

HUD Contact: Peter Ashley, DrPH (peter.j.ashley@hud.gov)

3) Funding for Carbon Monoxide (CO) Detectors in Public and other HUD-Assisted Housing
HUD currently requires that a working CO alarm be in a unit where required by the state or local government in its laws or codes and encourages CO alarm installation requirement where not required by the state or local government. HUD has up to $20 million available for Fiscal Year (FY) 2020 to be awarded competitively to public housing agencies to evaluate and reduce carbon monoxide and mold; the CO activities include the installation and replacement of CO alarms or combination smoke detector-CO alarm devices in public housing at high risk of having elevated CO levels. In the FY 2021 Budget, HUD has requested $35 million to fund a "CO Alarms Resident Safety Demonstration" in which the funds will be made available on a competitive basis for installation/replacement of CO (or combination) alarms in higher risk HUD-assisted housing.

HUD Contact: Warren Friedman, PhD, CIH (warren.friedman@hud.gov)

4) Radon Testing and Mitigation in HUD-Assisted Multifamily and Public Housing

HUD's Office of Multifamily Housing is proposing changes to strengthen their radon test requirements for FHA-insured multifamily housing. Specifically, the Office is proposing to remove the current exemption for properties located in EPA radon risk zone 3 (considered lowest risk) and increase the requirement for ground floor testing of housing units in multifamily housing to 100% of units to be consistent with the current ANSI/AARST consensus standard. In the 2021 Budget, HUD has requested $5 million for radon testing and mitigation in public housing units in areas identified by the EPA or a state or local government as having high potential for elevated radon levels.

HUD Contact: Peter Ashley, DrPH (peter.j.ashley@hud.gov)

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

CIAQ Webinar Presentations

Recordings of the following CIAQ presentations are now posted to the CIAQ website under the Meeting Materials tab (https://www.epa.gov/indoor-air-quality-iaq/federal-interagency-committee-indoor-air-quality):

- **October 16, 2019**
  - The National Academies of Sciences (NAS) Management of Legionella in Water Systems
  - The Rise of E-Cigarettes Implications for Public Health Policy and Practice
  - E-Cigarettes, Vaping, and Smokefree Indoor Air Policies in Public and Private Spaces: Trends, Challenges, Opportunities
- **June 5, 2019**
  - National Models for Asthma Care: Best Practices from a 2019 Asthma Award Winner
  - A Filter Forensics Approach for Exploring Environmental Exposures and Asthma Triggers in Homes
- **March 20, 2019**
  - Characterization of Particle and Chemical Emissions from 3D Printers

IAQ Science Webinars

IED recently hosted two webinars in the IAQ Science Webinar Series:

- ***The Influence of Clothing and Other Textiles on Your Exposure to Indoor Air Pollutants*:** This webinar featured a presentation by Dr. Glenn Morrison, a professor of Environmental Science and Engineering at The University of North Carolina at Chapel Hill. Dr. Morrison presented evidence from laboratory and human studies that demonstrates the importance of textiles in controlling exposure to indoor pollutants and suggests ways to use textiles to control exposure. (November 14, 2019)
- ***The Human Forest: Volatile Chemical Products Contribute to Urban Air Pollution*:** This webinar featured a presentation by Dr. Matthew Coggon, a Research Scientist at the Cooperative Institute for Research in Environmental Sciences (CIRES) and the Chemical Sciences Division of the NOAA Earth System Research Laboratory. Dr. Coggon presented recent work showing that emissions from consumer product and industrial solvent use, which predominantly originate in indoor environments, may contribute as much to the abundance of urban volatile organic compounds (VOCs) as the emissions from motor vehicles. (February 5, 2020)

Recordings of IAQ Science Webinars are posted at: https://www.epa.gov/indoor-air-quality-iaq)

IAQ Science

IED is developing new web content on Sensor Technology and Indoor Air Quality, and on Consumer-Oriented Air Pollutant Monitors for Indoor Air. IED's new web content will cover low-cost sensors and monitors for indoor air quality. Basic information about how air pollutant

monitors work will be presented, as well as information on the limitations of the technologies, how to use them indoors, and how to interpret readings from an air quality monitor for IAQ. The material is targeted for the general public. Once that material is posted, the content on sensor technology and IAQ will be expanded for more specific audiences and applications and updated as scientific consensus around the use of air quality monitors advances.

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. Along with its founding members, the American Lung Association 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 to save 3,200 lives by 2020. While the 2020 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.
Some highlights include:

- NRAP Leadership Council held their face-to-face meeting on December 11th in Washington DC. The meeting focused on celebrating the accomplishments and progress made to date on NRAP strategies and discussing updates and changes necessary to move NRAP beyond 2020.
- Discussion of developing a strategy for improving outcomes for the mortgage finance industry.
- Identification of state-level radon activities for targeted outreach on policy adoption/implementation and how NRAP can support these activities.

Credentialing of Radon Service Providers

As part of EPA's role to support state programs and to promote the availability of the best possible radon services to consumers, EPA issued a *Federal Register* (FR) Notice seeking public feedback on a proposed approach for developing voluntary criteria for organizations that credential radon service providers. These criteria will establish an ongoing and open evaluation process for organizations wanting to credential radon service providers. For more information about EPA's proposal visit www.epa.gov/radon.

State Indoor Radon Grants (SIRG)

EPA awarded $8M to states, territories, and tribes in FY19 to support radon programs under the SIRG Program. EPA plans to make similar SIRG awards in FY20.

The SIRG Summary Report on 2019 Activities was published in February 2020. This report highlights the important work states, territories, and tribes are undertaking across the country to advance risk reduction. (A link to the report is also available on EPA's SIRG Resources webpage.)

Building Codes

EPA continues to collaborate with industry and states to actively engage in efforts to promote adoption of radon-resistant new construction (RRNC) practices by 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.

- EPA developed several proposals for the ICC-700/ASHRAE-189.1 National Green Building Standard. The proposals now are in the final stages and awaiting ANSI approval. One of the proposals would require radon reducing features and testing in green-rated homes, including multi-family buildings and during renovations.
- There was an important development in radon building codes at the ICC Public Comment Hearings in Las Vegas at the end of October 2019. Joint testimony from CRCPD, AARST, and EPA opposed a sidewall venting proposal (RB-286) and supported a post-installation radon test proposal (RB-289), for the International Residential Code. RB-286 ultimately was disapproved and the EPA supported RB-289 was approved.
- RB-289 will be added to the voluntary Appendix F, requiring any new Appendix F adopters to test for radon after installing radon-reducing features. It is the first time that testing for radon appears in the International Residential Code (IRC).

Asthma

2020 National Environmental Leadership Award in Asthma Management

Each year, EPA honors exceptional asthma programs through the National Environmental Leadership Award in Asthma Management. For 2020, EPA revised the application to align with a program shift toward recognizing whole-community asthma care systems with an integration of the 3 categories (providers, plans, and communities in action) into one award application. The streamlined application maintains the three main topic areas: Comprehensive Asthma Management (includes Management and Operations, Integrated Health Care Services and Tailored Environmental Services); Getting Results; and Evaluation and Sustainability. This remains the only national award for excellence in comprehensive asthma care and the winners are selected through a highly competitive process which includes an expert review panel with representatives from EPA, CDC, HUD and other leaders in asthma care. Applications are under review at this time and winners will be announced in May to kick off Asthma Awareness Month. Winners will join EPA in Washington, DC, to receive their award and will be featured on a webinar in May. To date there have been 41 winners of this prestigious award. For more information and to learn about these award-winning programs, visit http://www.asthmacommunitynetwork.org/awards.

May is Asthma Awareness Month

May provides a great opportunity for EPA and others to raise asthma awareness and educate

stakeholders on the importance of comprehensive asthma management which includes medical

treatment and reducing exposures to environmental triggers. Use tools and resources on AsthmaCommunityNetwork.org to maximize your program's impact this May. Promote your Asthma Awareness Month events in the Events Calendar, and then connect with other programs by sharing your Asthma Awareness Month story in a Network Blog. If you are not already a member of the Network, we encourage you to join today and engage with over 1,100 asthma programs at: www.asthmacommunitynetwork.org.

Comprehensive IAQ Interventions in Homes

Indoor airPLUS: New Homes

At the end of 2019, EPA's Indoor airPLUS (IAP) program had its best 4th quarter for the number of newly labeled homes, which now total almost 23,000 homes across the United States. Two national production builders, Beazer Homes and Meritage Homes, are building hundreds of IAP labeled homes in Arizona and Florida, and EPA continues to offer technical and marketing support to new builder and rater partners. EPA will soon release an updated version of the IAP mobile app, which will include Revision 4 of the Construction Specifications.

The Indoor airPLUS (IAP) program is working on updated program requirements to be included in the IAP Version 2 (V2) Construction Specifications, anticipated to be released for public comment in 2020. Additionally, EPA is working to "re-release" an IAP partnership category for allied organizations such as manufacturers, service providers, or other IAQ stakeholders interested in supporting EPA's mission and developing IAP brand awareness. The revised "IAP Advocate Partnership" is also anticipated in late 2020. In the meantime, IAP staff continue to promote the program and provide educational outreach at conferences and events such as the International Builders' Show, RESNET, EEBA, and the National Home Performance Conference.

Indoor airPLUS: Existing Homes (IAP-X)

As part of IAP V2, the Indoor airPLUS program will include a labelling opportunity for existing homes. An EPA existing homes indoor air quality (IAQ) label will also provide new opportunities for home performance contractors and healthy home evaluators to partner with EPA to improve IAQ in the vast segment of existing homes throughout the country. The Indoor airPLUS program for existing homes -- IAP-X -- is expected to be released for public comment in 2020 along with V2 of new homes.

Energy Saving Plus Health Indoor Air Quality Guidelines for SF and MF:

EPA is updating its guidance for single-family (2011) and multi-family (2016) housing to address IAQ concerns and technology advancements during energy upgrades, through voluntary guidance that gives best practices for improving IAQ in conjunction with energy upgrade work. These 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. This will be finalized and released in May of 2020. The end result will be guidance that will not only help users improve their IAQ, but also will provide an opportunity to market improvements in existing homes.

Comprehensive IAQ Interventions in Schools

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

EPA continues promoting a suite of resources titled 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 indoor air quality (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. The resources are available online at: https://www.epa.gov/iaq-schools/indoor-air-quality-tools-schools-preventive-maintenance-guidance-documents
EPA HQ staff recently presented on Indoor Air Quality Tools for Schools: Preventive Maintenance Guidance Documents at the National and South Carolina School Plant Management Association meetings; the Green Schools National Conference and Expo; and the Clean Buildings Expo. In addition, the EPA staff in Regions 4 and 5 have held trainings for partner organizations and school districts in Michigan and Florida. These events addressed the dynamic intersection of IAQ, preventive maintenance and energy efficiency. These sessions provided knowledge and tools to support maintaining and improving healthier, stronger and safer cleaning programs that promote learning.

Expanding the Reach for School IAQ Training

EPA continues to actively deliver technical assistance to the schools' community through two professional training webinar series; the 10-part *IAQ Master Class Professional Training Webinar Series,* and the subsequent series, *IAQ Knowledge to Action Professional Training Webinar Series.* Since the launch in 2015, more than 3,000 participants have generated nearly 6,000 views of the trainings. All webinars are available "on demand." Register to view the webinars at www.epa.gov/iaq-schools/indoor-air-quality-master-class-professional-training-webinar-series.
EPA is eager to drive even more 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 EPA's IAQ Master Class Professional Training Webinar Series.

Improved Household Energy

ISO Standards

In the fall of 2019, the International Organization for Standardization (ISO) published the first international standard on "Guidance on Field Testing Methods for Cookstoves." The new standard includes protocols to test and report the emissions, efficiency, safety and durability of cookstoves in a field setting. The field-testing standard now joins an ISO harmonized laboratory testing standard that was finalized in 2018. Together, these standards will serve as the basis for national policies and programs on cookstoves, while also incentivizing manufacturers and developers to improve stove quality and performance. An accompanying ISO technical report that benchmarks performance to voluntary performance targets, or tiers, and provides guidance on how to understand and interpret laboratory test results was also approved by member countries of the ISO Committee and published. Development of these standards was led by EPA staff. These voluntary documents provide a framework for organizations, countries and regions to adapt and implement the protocols, metrics and targets based on their priorities over the coming months and

years. EPA is working with the World Health Organization, the Clean Cooking Alliance, and ISO to organize and facilitate regional workshops to promote the adoption or the adaptation of the ISO harmonized laboratory standards for clean cookstoves and clean cooking practices by countries. The first workshop was held in Nepal for Asian countries in December 2018. The second workshop was held in Uganda for English-speaking African countries in July 2019. At both workshops, the partners also organized a concurrent workshop for staff of household energy laboratories to provide technical assistance and guidance on laboratory testing methods contained in the new ISO standard. A third regional workshop is scheduled to be held in Senegal in June 2020 for Francophone African countries (and Haiti), and later in 2020, a fourth workshop will be held in Latin America. ISO standards are reviewed and updated regularly, so these standards can be updated based on future research and on the progress in the cookstove and fuel market.

Consider Subscribing to Email Alerts on IAQ Topics

EPA offers a free subscription service for information on over 20 indoor air topics—opt-in at public.govdelivery.com/accounts/usepaiaq/subscriber/new to receive email updates on IAQ. More than 99,000 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 and air quality in schools. Many topics are also presented in Spanish. Subscriptions can be cancelled easily at any time.