Indoor Air Quality and Covid How EH Responded

Environmental Health Professionals Unrecognized Heroes of Covid Pandemic



We're a Mile Wide and an Inch Deep Our Broad Expertise is Required

- Acrylamide
- Agricultural Health
- Air Pollution and Your Health
- Algal Blooms
- Allergens & Irritants
- Aloe Vera
- Alternatives to Animal Testing
- Arsenic
- Asthma
- Autism
- Autoimmune Diseases
- Biomarkers
- Bisphenol A (BPA)
- Breast Cancer
- Cancer
- Cell Phone Radio Frequency Radiation
- Chemical Mixtures
- Children's Environmental Health
- Climate Change
- Cosmetics and Your Health
- Dioxins

- Dust Mites and Cockroaches
- Electric & Magnetic Fields
- Emergency Response
- Endocrine Disruptors
- Epigenetics
- Essential Oils
- Exposure Science
- Flame Retardants
- Formaldehyde
- Gene and Environment Interaction •
- Ginkgo
- Global Environmental Health and
 Sustainable Development
- Hazardous Material/Waste
- Hexavalent Chromium
- Hydraulic Fracturing & Health
- Indoor Air Quality
- Inflammation
- Kidney Disease
- Lead
- Lung Diseases
- Mercury

- Microbiome
- Mold
- Nanomaterials
- Obesity
- Ozone
- Parkinson's Disease
- Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS)
- Pesticides
- Pet Allergens
- Pollen
- Radon
- Reproductive Health
- Safe Water and Your Health
- Smoking and Vaping
- Soy Infant Formula
- Styrene
- Toxicology
- Weather Extremes
- Women's Health and the Environment
- Workers' Health

Public Health Was Spearheaded by EH

- 1895: APHA publishes the Standard Methods for the Examination of Water and Sewage
- 1900: Walter Reed reports at the APHA Annual Meeting that mosquitoes carry yellow fever
- 1905: APHA publishes the Standard Methods for the Examination of Milk"



Environmental Health is Public Health



ENVIRONMENTAL HEALTH WORKFORCE NEEDS ASSESSMENT IN RESPONSE TO COVID-19

NATIONAL ENVIRONMENTAL HEALTH ASSOCIATION OCTOBER 2020

Respondent	Frequency
Other (please specify)	51
City or County Health Department	399
State Health Department	150
Federal Agency	28
Uniform Services	21
Tribal Health Services	9
Health Program within a U.S. Territory	2
Private Sector	73
Academia	24
Independent nonprofit (NGO)	8
Total	765

Our Understanding of Human Needs is Key



We Bring the Expertise of Science AND Health



Our Expertise Reduces Impact of Disasters



Our Success is Our Downfall



We've Helped Shift Burden of Infectious Disease





Never Let a Good Crisis Go to Waste





Environmental Health is More Vital Than Ever

More than 40 percent of Americans live in counties hit by climate disasters in 2021

As climate-fueled extreme weather intensified last year, more than 80 percent of Americans experienced a heat wave. The impacts of fires and severe storms also spread.







Source: Preventing disease through healthy environments: a global assessment of the burden of disease from environmental risks, WHO, 2012. Updated 2016 data tables.

Airborne Transmission of SARS-CoV-2

- Transmission of SARS-CoV-2 through the air is sufficiently likely that airborne exposure to the virus should be controlled
- Changes to building operations, including the operation of HVAC systems can reduce airborne

exposures

COVID-19

• The more people a person interacts with, and the longer the interaction, the higher the risk of COVID-19 spread





Top Things You Need to Know

Variants are expected

- The best way to slow the emergence of new variants is to reduce the spread of infection by taking measures to protect yourself including getting a COVID-19 vaccine
- Vaccines keep you from getting sick, being hospitalized, or dying from COVID-19
- All COVID-19 tests can detect all variants, but they will not tell you which variant you have

Break through Infections

- For some diseases that the dose of virus a person is exposed to will directly correlate with how severe the disease is
 - A 2015 study from the US showed that the higher the dose of influenza virus given to healthy volunteers, the worse their symptoms.
 - Viruses are tiny particles that must get into our cells in order to replicate, so the logic is that the more starting virus particles there are, the more cells will be infected.
 - For half the population, it takes just 18 particles of norovirus to cause an infection.

COVID 19

- Unknown how long the air inside a room occupied by someone with confirmed COVID-19 remains potentially infectious
 - Influenced by numerous factors
 - Size of the room
 - Ventilation system design
 - Air changes per hour
 - Location of supply and exhaust vents



Why Care about IAQ/IEQ?



Why Now

- New schools are built for energy efficiency
 - Buildings now are built "tight" and are usually constructed with toxic materials
 - Building shell traps pollutants
 - Hotels or schools in which occupants cannot open windows

http://www.google.com/imgres?q=tight+house&hl=en&sa=X&rls=com.microsoft:en-us:IE-

 $SearchBox\&rlz=117GGLL_en\&biw=1280\&bih=834\&tbm=isch\&prmd=imvnsu\&tbnid=Wr3JT6gEPTMHxM:\&imgrefurl=http://blog.builddirect.com/greenbuilding/tight-house-fresh-air/&docid=7sEp1CX_ejOZ2M&imgurl=http://blog.builddirect.com/greenbuilding/wp-content/uploads/2010/04/house-leaks-with-text-$

800.jpg&w=800&h=859&ei=fnugTpzyEoWqsQLIhoDHBQ&zoom=1&iact=rc&dur=149&sig=102373220233018260884&page=1&tbnh=159&tbnw=147 &start=0&ndsp=23&ved=1t:429,r:0,s:0&tx=60&ty=36



Why Now

- New buildings are built for energy efficiency
 - Inadequate moisture control increases mold growth
 - Fewer windows creating less cross ventilation
 - Less fresh air introduced into the building
 - Fewer air changes per hour



Why Now

- Most people spend 90% of their time indoors
 - Infants, elderly & infirm spend most of their time indoors
- Activities put people in close proximity to sources
- Rule of 1000
 - Indoor pollutants 1000 X more likely to be inhaled





Mold

- Mold is everywhere in the environment
- Humidity and temperature key to growth
- Moisture problems can be caused by "tight homes",& common household activities such as cooking, cleaning & bathing
 - Average household of 4 creates
 3-6 gallons of water/day into the air
 - 3 pints breathing
 - cooking & dishwashing ~1 pint/meal
 - ½pint from taking a shower



Evaluation

- CO₂
 - Often used as a surrogate for the outside air rate
 - It is not the carbon dioxide concentrations causing these symptoms; but, if carbon dioxide increases, so may other airborne contaminants
 - May be some combination of these substances that makes people sick or uncomfortable
 - CO₂ is not an effective indicator of ventilation adequacy if the area is not occupied at its usual level



Evaluation

- ASHRAE 62, Ventilation for Acceptable Indoor Air Quality
- The ASHRAE 62 is a design standard, not a health standard
 - Proposes a target concentration of 1,000 ppm carbon dioxide
 - Includes flow measurement recommendations on ventilation equipment
 - Requires air handling equipment be accessible for inspection, cleaning and maintenance

Evaluation

- Fresh air supply assumes the air taken from outside the building is free of contamination and has levels usually between 300 ppm to 500 ppm CO₂
- ASHRAE 62 suggests the following interpretation for CO₂ levels
 - <600 ppm reflects adequate fresh air supply</p>
 - 600 to 800 ppm will produce occasional complaints
 - 800 to 1,000 ppm will produce increasing complaints
 - > 1,000 ppm or levels 700 ppm above outdoor concentrations can be interpreted as inadequate fresh air supply
 - Comfort criteria are likely to be satisfied below 1,000 ppm CO2
 - At concentrations above 1,000 ppm, complaints of headaches, tiredness& eye, nose & throat irritation may be more prevalent 25

COVID-19

- Humidification and air-conditioning have no practical effect
 - Coronaviruses are quite resistant to environmental changes and are susceptible only for a very high relative humidity above 80% and a temperature above 30 °which are not attainable and acceptable in buildings for other reasons
 - Thermal comfort and microbial growth



COVID-19

- SARS-CoV-2 has been found highly stable for 14 days at 4 °C; 37 °C for one day and 56 °C for 30 minutes were needed to inactivate the virus
- Evidence does not support moderate humidity (RH 40-60%) will be beneficial in reducing viability of SARS-CoV-2, thus humidification is NOT a method to reduce the viability of SARS-CoV-2



- Ventilation and filtration provided by HVAC systems can reduce the airborne concentration of SARS-CoV-2 and thus the risk of transmission through the air
- Unconditioned spaces can cause thermal stress to people that may be directly life threatening and may also lower resistance to infection
- In general, disabling of heating, ventilating, and air-conditioning systems is not a recommended measure to reduce the transmission of the virus

- Supply clean air to susceptible occupants
- Containing contaminated air and/or exhaust it to the outdoors
- Diluting the air in the space with clean and filtered outdoor air
- Cleaning the air within a room



• In vacant buildings it is not recommended to switch ventilation off, but to operate continuously at reduced speed



- The amount of fresh air needed is directly related to occupancy
 - More people
 - Greater Density
 - Need more fresh air
- Pressurization
 - Should be under positive pressure with respect to the outside



- Increase outdoor air ventilation
 - Outdoor air ventilation rate per person is critical
 - Increases the effective dilution ventilation per person
 - Use caution in highly polluted areas
- Disable demand-controlled ventilation (DCV)
- Open minimum outdoor air dampers 100%
 - Eliminating recirculation
 - In mild weather this shouldn't affect thermal comfort or humidity, but will be more difficult in extreme weather



- Increase outdoor air ventilation
 - Best time for this to occur could be during unoccupied hours
 - Many HVAC systems are most likely not designed to maintain temperature and humidity set points with large amounts of outside air



- Ensure ventilation systems operate properly and increase circulation of outdoor air as much as possible
 - Opening windows
 - Do not open windows if doing so poses a safety or health risk to
 people using the facility
 - Risk of falling
 - Triggering asthma symptoms
 - Security



- Run fan in constant mode 24 hours a day
 - Provide flushing at nominal speed (full load) a minimum of two hours before and post occupancies
 - In demand controlled ventilation systems change CO₂ set point to 400 ppm to assure the operation at nominal speed



- Operating exhaust fans as well as opening the outside air dampers
 - For buildings without the capacity to treat large quantities of outside air and when outside air conditions are moderate, open all windows for a minimum of two hours before reoccupation



- Do not recirculate air
- Switch air handling units with recirculation to 100% outdoor air
 - Close the recirculation dampers
 - Building Management System or manually



- Some air handling units and recirculation sections are equipped with return air filters
 - This should not be a reason to keep recirculation dampers open
 - These filters normally do not filter out particles with viruses effectively since they have standard efficiencies PM_{10} filter class & not HEPA efficiencies



COVID-19 Mechanical Duct Cleaning

- Has no practical effect
 - Mechanical Duct cleaning offered by companies (removing dust and debris) is not effective against room-to-room infection because the HVAC system is not a contamination source if guidance about heat recovery and recirculation is followed
 - Viruses attached to small particles will not deposit easily in ventilation ducts & normally will be carried out by the air flow
 - No changes are needed to normal mechanical duct cleaning and maintenance procedures
- More important increase fresh air supply, avoid recirculation of air according to the recommendations above



COVID-19 Outdoor Air Filters

- Increasing changing of outdoor air filters not necessary
 - Modern HVAC systems are equipped with fine outdoor air filters right after the outdoor air intake (filter class PM_{2.5} or PM₁) which effectively filter particulate matter from outdoor air
 - In rare cases of virus contaminated outdoor air, standard fine outdoor air filters provide a reasonable protection
 - Normal maintenance procedures can be used
 - It is not recommended to change existing outdoor air filters and replace them with other type of filters or recommend changing them sooner than normal



COVID-19 Controls

- Installing filtration
- Bi-polar ionization
- UV lights at return air openings and at components within the air system
- Implementing pressurization control and/or enhance current practices
- Increasing airflow
- Deactivating demand control systems that limit concentration of outside air



COVID-19 Controls

- Operate systems longer and with higher outside air content to flush spaces due to increased use of cleaners
- Operate ventilation systems serving communal spaces such as bathrooms continuously (24 hours/day)
 - Higher risk of contamination
 - Ensure that negative pressure is created, especially to avoid the fecal-oral transmission
- Maintain minimum relative humidity levels
- Sanitize ductwork with aerosol sprays or UV light
- Use portable air purifiers



Minimum Efficiency Reporting Values

- Filter's ability to capture larger particles between 0.3 and 10 microns (µm)
 - Helpful in comparing the performance of different filters
 - The rating is derived from a test method developed by ASHRAE
 - Higher the MERV rating the better the filter is at trapping specific types of particles



Filtration

- Improve HVAC air filtration to MERV-13 or the highest compatible with the filter rack
- Seal edges of the filter to limit bypass

MERV RATING CHART

Standard 52.5 Minimum Efficiency Reporting	Dust Spot	Arrestance	Typical Controlled	Typical Applications and	Tunical Air FilteriCleaner Tune
Value	Enterency	Alleanance	Containinant	Linitationa	>99.999% eff. On .1020 pm
20	n/a	n/a	< 0.30 pm particle size	Cleanrooms	Particles
19	n/a	n/a	Virus (unattached)	Radioactive Materials	Particles
18	n/a	n/a	Carbon Dust	Pharmaceutical Man.	Particulates
17	n/a	n/a	All Combustion smoke	Carcinogenetic Materials	>99.97% eff. On .30 pm Particles
16	n/a	n/a	.30-1.0 pm Particle Size	General Surgery	Bag Filter- Nonsupported
15	>95%	n/a	All Bacteria	Hospital Inpatient Care	microfine fiberglass or synthetic media, 12-36 in. deep, 6-
14	90-95%	>98%	Most Tobacco Smoke	Smoking Lounges	12 pockets Box Filter- Rigid Style Cartridge Filters 6 to 12" deep m ay use
13	89-90%	>98%	Proplet Nuceli (Sneeze)	Superior Commercial Buildings	lofted or paper media.
12	70-75%	>95%	1.0-3.0 pm Particle Size	Superior Residential	Bag Filter- Nonsupported
			Legionella		microfine fiberglass or synthetic media, 12-36 in. deep, 6-
11	60-65%	>95%	Humidifier Dust	Better Commercial Buildings	12 pockets
			Lead Dust		Box Filter- Rigid Style Cartridge
10	50-55%	>95%	Milled Flour		lofted or paper media.
			Auto Emissions	Hospital Laboratories	
9	40-45%	>90%	Welding Fumes		
8	30-35%	>90%	3.0-10.0 pm Particle Size	Commercial Buildings	Pleated Filters- Disposable, extended surface area, thick with
7	25.30%	>00%	Mold Spores	Patter Peridential	cotton-polyester blend media, cardboard frame
	20-00 %	- 20 %	nan opray	Dener Personna	Cartridge Filters- Graded density viscous coated cube or pocket
			Fabric Protector		filters, synthetic media
6	<20%	85-90%	Dusting Aids	Industrial Workplace	Throwaway- Disposable
			Cement Dust		synthetic panel filter.
5	<20%	80-85%	Pudding Mix	Paint Booth Inlet	Throwaway, Disposable
4	<20%	75-80%	>10.0 pm Particle Size	Minimal Filtration	fiberglass or synthetic panel filter.
3	<20%	70.75%	Dust Mites	Residential	Washable, Aluminum Mesh
-			Sanding Dust		
2	<20%	65-70%	Spray Paint Dust		
-			Textile Fibers	Window A/C Units	Electrostatic- Self charging woven panel filter.
1	<20%	<65%	Carpet Fibers		

Minimum Efficiency Reporting Values

• The higher the rating the more often you will need to change

MERV	Min. particle size	Typical controlled contaminant ^[2]
1–4	> 10.0 µm	Pollen, dust mites, cockroach debris, sanding dust, spray paint dust, textile fibers, carpet fibers
5–8 ^[3]	10.0–3.0 µm	Mold spores, dust mite debris, cat and dog dander, hair spray, fabric protector, dusting aids, pudding mix
9–12	3.0–1.0 µm	Legionella, humidifier dust, lead dust, milled flour, auto emission particulates, nebulizer droplets
13–16	1.0–0.3 µm	Bacteria, droplet nuclei (sneeze), cooking oil, most smoke and insecticide dust, most face powder, most paint pigments

High Efficiency Particulate Air Filter (HEPA Filters)

- Type of pleated mechanical air filter
 - Theoretically removes at least 99.97% of dust, pollen, mold, bacteria, and any airborne particles with a size of 0.3 microns (µm)
 - 0.3 microns responds to the most penetrating particle size (MPPS)
 - Particles that are larger or smaller are trapped with even higher efficiency



HEPA Filters

- Efficiency of these filters will improve as they become loaded
 - Not desirable to constantly change these filters



HEPA Filters

- Disadvantage
 - High Pressure Drops
 - A high-pressure drop filter can cause more air to bypass the filter if it is not properly installed & sealed
 - Can diminish the amount of air supplied into building
 - Can end up compromising air flow based on the performance of the existing fans
 - To minimize pressure drop
 - Lower depth HEPA filters can be utilized
 - Add booster fans to accommodate the higher pressures



Bi-Polar Ionization

- Releases positive & negative ions into the airstream
 - The ions latch onto and neutralize any contaminants they come into contact with
 - Charged particles are drawn together, forming clusters, which become heavy enough to drop out of the air
 - Does not remove the contaminant but helps enhance the filtration system ability to capture the contaminant
 - Requires vigorous cleaning procedures of all surfaces within the workplace environment
 - To be effective must constantly operate to maximize effectiveness



UVC Light

- At strategic locations within the duct system will kill microorganisms in the airstream
 - Placement is important since the coronavirus must be exposed for a period of time
 - Requires multiple UVC lamps within the airstream
 - May require long sections of UVC light arrays
 - Manufacturers are recommending exposure of 10 seconds within proximity of the UVC bulb



Disinfection

• Generally not recommended

- Outdoor air is NOT a contamination source
- Cost
- Maintenance





RETAIL FOOD SAFETY REGULATORY TRAINING NEEDS ASSESSMENT

Be part of this historical national assessment to:

- Identify strengths and gaps in educational resources for the retail food safety regulatory professional
- Give input on jurisidiction-level training needs
- Help continue to build a robust national Integrated Food Safety System

Outcomes

- Bolster educational resources
- Reduce knowledge gaps in training materials
- Improve workforce capabilities

WWW.NEHA.ORG/RETAILGRANTS/RPSS/NEEDS-ASSESSMENT



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