December 5, 2022

The Honorable Michael S. Regan
Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, DC 20460

RE: Request for Information on Bettering Indoor Air Quality, Docket ID No. EPA-HQ-OAR-2022-0794

Dear Administrator Regan and EPA Staff,

On behalf of the undersigned organizations, thank you for the opportunity to provide input on EPA's efforts to improve indoor air quality for public health. Despite significant improvements in air quality since Congress passed the original Clean Air Act over half a century ago, air pollution is still responsible for up to 200,000 excess deaths annually in the United States.[1] Until now, remedial action has largely focused on sources that emit pollution to the outdoor environment. However, the ongoing COVID-19 pandemic has brought indoor air quality to the forefront– and for good reason. Indoor air quality is just as, if not more, determinative of public health outcomes than outdoor air quality because the average U.S. resident spends almost 90 percent of their time indoors.[2] Between healthcare costs, avoidable deaths, and lost productivity, EPA estimates suggest that avoidable costs associated with indoor air pollution top $100 billion annually.[3] With climate change driving increasing numbers of severe weather events and disease outbreaks that confine people indoors, these numbers have likely grown in recent years.

Reducing pathogens, including the COVID-19 virus, in indoor environments is an important policy goal. However, pathogens are just one of the many categories of pollutant currently affecting indoor air quality, and consequently, human health. Fossil fuel-fired appliances, excessive moisture, building materials, and infiltration of outdoor pollutants are also significant sources of harmful indoor pollution. Moreover, these issues are inextricably bound up with other

[1] Sumil K. Thakrar et al., *Reducing Mortality from Air Pollution in the United States by Targeting Specific Emission Sources*, 7 Envtl. Sci. & Tech. Letters 639, 639 (2020), https://pubs.acs.org/doi/10.1021/acs.estlett.0c00424.
[2] Neil E. Klepeis et al., The National Human Activity Pattern Survey (NHAPS): A Resource for Assessing Exposure to Environmental Pollutants, 11 J. EXPOSURE ANALYSIS & ENVTL. EPIDEMIOLOGY 231, 242 (2001).
[3] David E. Jacobs et al., *Linking Public Health, Housing, and Indoor Environmental Policy: Successes and Challenges at Local and Federal Agencies in the United States*, 115 Envtl. Health Perspectives 976, 977 (2007), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1892139/pdf/ehp0115-000976.pdf.

social determinants of health like race, income, and geographic location.[4] To reduce health inequities driven by poor indoor air quality, EPA must take a holistic approach that encourages decarbonization, weatherization, energy efficiency, and pollution remediation in addition to adequate ventilation and filtration. Accordingly, we have incorporated these practices and values into our comments below.

3.1 In your opinion, what approach(es) could the Federal government consider deploying to move decision makers/owners/managers toward making and sustaining improved ventilation, filtration, and air cleaning practices to reduce the risk of disease transmission?

As mentioned above, reducing disease transmission is just one facet of improving health outcomes associated with indoor air quality. Focusing on a single cause of illness to the exclusion of other interrelated and concurrently addressable causes is inefficient and potentially misleading. Thus, in developing incentives to encourage indoor air quality improvement measures, EPA should design its programming to be flexible, allow building owners to respond to community needs, and reward building owners and operators who pursue a multifaceted approach.

The first step in addressing indoor air quality is raising awareness of the various sources of pollution. Awareness campaigns that aim to improve indoor air quality should discuss not only precautions against transmission of COVID-19 and other illnesses, but also steps to prevent fossil fuel-fired appliance pollution, mold, lead dust, materials off-gassing, and infiltration of outside pollutants like radon, diesel fumes, and wildfire smoke.

Fossil fuel combustion is notorious for creating greenhouse gasses that contribute to climate change. However, burning fossil fuels also releases a host of other chemical compounds, many of which are harmful to human health. For instance, burning methane gas– as many U.S. buildings do for temperature control, water heating, and cooking[5]– generates carbon dioxide, carbon monoxide, nitrogen dioxide, particulate matter, and volatile organic compounds (VOCs) such as formaldehyde.[6] Further, recent research demonstrates that gas stoves leak unburned gas

[4] "Social determinants of health are the conditions in the environments where people are born, live, learn, work, play, worship, and age that affect a wide range of health, functioning, and quality-of-life outcomes and risks." U.S. Department of Health and Human Services, Social Determinants of Health, https://health.gov/healthypeople/priority-areas/socialdeterminants-health (last accessed Dec. 3, 2022).

[5] U.S. Energy Information Administration, *Natural Gas Explained*, https://www.eia.gov/energyexplained/natural-gas/use-of-natural-gas.php (last visited Dec. 2, 2022) (estimating that half of U.S. households use gas for space and water heating); *see also* Eric D. Lebel et al., *Methane and NOx Emissions from Natural Gas Stoves, Cooktops, and Ovens in Residential Homes*, 56 ENVTL. SCI. & TECH. 2529, 2529 (2022).

[6] DR. YIFANG ZHU ET AL., UCLA FIELDING SCHOOL OF PUBLIC HEALTH, EFFECTS OF RESIDENTIAL GAS APPLIANCES ON INDOOR AND OUTDOOR AIR QUALITY AND PUBLIC HEALTH IN CALIFORNIA 6-11 (2020), https://ucla.app.box.com/s/xyzt8jc1ixnetiv0269qe704wu0ihif7; Heather Payne & Jennifer D. Oliva, Warrantying Health Equity, 70 UCLA Law Rev. (forthcoming 2023) at 11, available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4188216 (last accessed Sept. 28, 2022).

containing carcinogenic pollutants into homes at a near-constant rate, even when the appliances are not in use.[7] In all, pollutants released from fossil fuel-fired appliances and associated onsite infrastructure can lead to numerous health problems, including but not limited to asthma and other respiratory conditions, cardiovascular disease, neurological disorders like ADHD, and even cancer and death.[8] Black, Indigenous, and People of Color (BIPOC) individuals are more likely to experience the poor environmental conditions that lead to and exacerbate many of these ailments.[9]

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[7] Drew R. Michanowicz et al., *Home Is Where the Pipeline Ends: Characterization of Volatile Organic Compounds Present in Natural Gas at the Point of the Residential End User*, 56 ENVTL. SCI. & TECH. 10258, 10258 (2022) (identifying 296 volatile organic compounds aside from methane in cooking gas samples); Eric D. Lebel et al., *Composition, Emissions, and Air Quality Impacts of Hazardous Air Pollutants in Unburned Natural Gas from Residential Stoves in California*, 56 ENVTL. SCI. & TECH. 15828, 15831-32 (2022) (finding hazardous air pollutants in unburned gas samples).

[8] *See* Jennifer M. Logue et al., *Pollutant Exposures from Natural Gas Cooking Burners: A Simulation-Based Assessment for Southern Californians*, 122 ENVTL. HEALTH PERSPECTIVES 43, 47, 49-50 (Jan. 2014) (demonstrating that homes with gas stoves regularly exceed EPA's limit for outdoor nitrogen dioxide exposure); Anna Belova et al., American Lung Association, Literature Review on the Impacts of Residential Combustion xii (July 2022), https://www.lung.org/getmedia/2786f983-d971-43ad-962b-8370c950cbd6/icf_impacts-of-residential-combustion_final_071022.pdf (concluding that indoor exposure to nitrogen dioxide from gas cooking can "exacerbate asthma symptoms, wheeze, [lower respiratory infections], and result in reduced lung function parameters in children."); Li Shang et al., *Effects of Prenatal Exposure to NOx on Children's Neurological Development: A Systematic Review and Meta-analysis*, 27 ENVTL. SCI & POLLUTION RES. 24786, 24794-24796 (2020) (linking prenatal nitrogen dioxide exposure to negative impacts on psychomotor skills); Eva Morales et al., *Association of Early-Life Exposure to Household Gas Appliances and Indoor Nitrogen Dioxide with Cognition and Attention Behavior in Preschoolers*, 169 AM.J. OF EPIDEMIOLOGY 1327, 1331 (2009) (linking childhood exposure to elevated nitrogen dioxide levels to ADHD and lower cognitive outcomes); Dr. Dennis J. Kotchmar et al., EPA, Integrated Science Assessment for Nitrogen Dioxide – Health Criteria 3-5, 3-9, 3-17, 3-41. (July 2008) (linking elevated nitrogen dioxide levels to respiratory impacts and allergic responses); EPA, INTEGRATED SCIENCE REPORT FOR PARTICULATE MATTER ES-12—ES-17 (2019), available at https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=347534 (noting that exposure to particulate matter can lead to irregular heartbeat, heart attack, asthma, decreased lung function, nervous system impacts, cancer, and even premature death in people with heart or lung disease in the general population); CENTER FOR DISEASE CONTROL, POISONING: PICTURE OF AMERICA REPORT 1, https://www.cdc.gov/pictureofamerica/pdfs/Picture_of_America_Poisoning.pdf (last visited July 31, 2022) (listing carbon monoxide as the leading cause of non-drug poisoning deaths in the U.S.); U.S. ENVIRONMENTAL PROTECTION AGENCY, Carbon Monoxide's Impact on Indoor Air Quality, https://www.epa.gov/indoor-air-quality-iaq/carbon-monoxides-impact-indoor-air-quality (last visited July 19, 2022) (disclosing that even low-level carbon monoxide exposure causes fatigue, headaches, reduced brain function, and chest pain); U.S. ENVIRONMENTAL PROTECTION AGENCY, What Should I Know About Formaldehyde and Indoor Air Quality, https://www.epa.gov/indoor-air-quality-iaq/what-should-i-know-about-formaldehyde-and-indoor-air-quality (last visited July 19, 2022) (naming formaldehyde as a carcinogen); ROY HARRISON ET AL., WORLD HEALTH ORGANIZATION, WHO GUIDELINES FOR INDOOR AIR QUALITY: SELECTED POLLUTANTS (2010), https://www.ncbi.nlm.nih.gov/books/NBK138708/ (noting that there is no safe level of benzene exposure).

[9] Aneesh Patnaik et al., Racial Disparities and Climate Change (Aug. 15, 2020), https://psci.princeton.edu/tips/2020/8/15/racial-disparities-and-climate-change.

A holistic awareness program for improving indoor air quality must also address other building conditions that commonly contribute to health impacts. For example, excessive moisture and mold are serious–but common–health hazards. Mold creates eye, skin, and respiratory ailments, especially in children, the elderly, and immunocompromised individuals.[10] In fact, a 2009 Surgeon General report estimated that mold in homes with inadequate ventilation contributed to 21 percent of all asthma cases.[11] To prevent mold, EPA recommends maintaining humidity at between 30 and 50 percent.[12] However, the benefits of humidity control extend beyond mold prevention; COVID-19 outcomes are less severe at between 40 and 60 percent relative humidity.[13] Thus, EPA should elevate the maintenance of between 40 and 50 percent relative humidity indoors as a healthy home solution.

Lead-based hazards, especially prominent in older homes, are another toxin adversely affecting health. In a 2020 public health study, researchers noted that Black children are more likely to grow up in older, substandard housing where substandard interior paint conditions exposed them to lead dust contamination.[14] Many Black households are renters, making them more vulnerable to housing discrimination and retaliation from landlords. To implement equitable standards for indoor air quality, EPA must consider disparities in healthcare, secure housing, income, and education to begin and ensure that benchmarking, inspection, and prevention are being upheld.

Likewise, EPA's clean indoor air programming should continue to raise awareness about household materials that off-gas hazardous chemicals.[15] Where clean, safe alternatives are available, the most logical and effective solution to pollution is proper disposal and replacement of the pollution source. Ventilation and filtration are limited solutions that do not eradicate pollution even when properly paired, especially in communities where outdoor pollution levels are

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[10] Mold and Health, https://www.epa.gov/mold/mold-and-health (last visited July 19, 2022); Mold, https://www.cdc.gov/mold/ (last visited July 19, 2022); ; see also INSTITUTE OF MEDICINE COMMITTEE ON DAMP INDOOR SPACES AND HEALTH, DAMP INDOOR SPACES AND HEALTH, Ch.5 Human Health Effects Associated with Damp Environments 31-46 (2004), https://www.ncbi.nlm.nih.gov/books/NBK215650/?report=reader.

[11] Evan Lemire et al., *Unequal Housing Conditions and Code Enforcement Contribute to Asthma Disparities in Boston, Massachusetts*, 41 HEALTH AFFAIRS 563, 563 (2022).

[12] U.S. EPA, Mold Course Chapter 2: Why and Where Mold Grows, https://www.epa.gov/mold/mold-course-chapter-2 (last accessed Dec. 4, 2022).

[13] C.A. Verheyen & L. Bourouiba, *Associations between Indoor Relative Humidity and global COVID-19 Outcomes*, 19 J. R. Soc. Interface 1, 11 (2022), https://doi.org/10.1098/rsif.2021.0865.

[14] Deniz Yeter et al., *Disparity in Risk Factor Severity for Early Childhood Blood Lead among Predominantly African-American Black Children: The 1999 to 2010 US NHANES*, 17 Int J Environ Res Public Health 1552, 4 (2020), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7084658.

[15] *See, e.g.*, U.S. EPA, Make Your House A Healthy Home & More Environmentally Friendly, Too!, https://www.epa.gov/sites/default/files/2014-05/documents/healthy_homes_brochure_english.pdf (2014) (disclosing the health impacts of VOCs from building components).

relatively high.[16] Rather than touting ventilation and filtration as complete solutions, EPA's awareness campaigns should encourage building developers to avoid and, ultimately, eliminate toxic materials from indoor environments. The agency could begin by raising awareness of the Living Building Challenge Red List–a tool that tracks harmful materials– and incorporate the list into any incentives that reward building owners and developers for eschewing red-listed materials.[17]

Though eradicating pollution sources is critical, ventilation and filtration are still important tools in improving indoor air quality. As EPA raises awareness of harmful materials and practices, the agency should also increase awareness of and access to mitigation technologies for all households. For example, in accordance with ASHRAE recommendations, EPA could endorse MERV 13 and HEPA filters to remove COVID pathogens and other pollutants including particle pollution from wildfire smoke.[18] EPA could also spread information about low-cost air quality solutions like Corsi-Rosenthal boxes.[19] For low-income households with high wildfire risk, EPA could also distribute materials to make these simple, emergency air filters.

Up-front costs are often a barrier to removing pollution sources and replacing necessary appliances with cleaner, safer alternatives. Therefore, approaches to remediating indoor air quality should include financial support and incentives specifically for low-income communities. Though the recently enacted Inflation Reduction Act created helpful tax credits and rebates for highly efficient electric appliances and associated upgrades,[20] low-income renters are often precluded

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[16] *See* World Health Organization, Roadmap to improve and ensure good indoor ventilation in the context of COVID-19 4 (2021) (noting that portable air filters were effective in reducing particulate matter concentrations by 40-82 percent and that ventilation alone is ineffective where outdoor pollution levels are relatively high); NATIONAL CENTER FOR HEALTHY HOUSING, STUDYING THE OPTIMAL VENTILATION FOR ENVIRONMENTAL INDOOR AIR QUALITY 2 (2022) (noting that neither nitrogen dioxide nor particulate matter are eliminated by ventilation); *See generally* Mary Angelique G. Demetillo et al., *Space-Based Observational Constraints on NO2 Air Pollution Inequality From Diesel Traffic in Major US Cities*, 48 Geophysical Res. Letters (Aug. 2021), https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1029/2021GL094333 (describing increased levels of nitrogen dioxide from diesel fumes in low-income communities and communities of color).

[17] International Living Future Institute, *The Living Building Challenge (LBC) Red List 2022 Updates: A Guide for Manufacturers*, https://living-future.org/wp-content/uploads/2022/05/The-LBC-Red-List-2022-and-PFAS-Guide-for-Manufacturers.pdf (last accessed Dec. 3, 2022).

[18] ASHRAE, *Filtration and Disinfection FAQ*, https://www.ashrae.org/technical-resources/filtration-and-disinfection-faq (last accessed Dec. 4, 2022); U.S. ENVIRONMENTAL PROTECTION AGENCY, *Why Wildfire Smoke Is a Health Concern*, https://www.epa.gov/wildfire-smoke-course/why-wildfire-smoke-health-concern (last visited July 19, 2022).

[19] Cristina Deptula, UC Davis, *UC Davis Engineering Students Compete to Build Corsi-Rosenthal Air Purifiers*, (March 1, 2022), https://engineering.ucdavis.edu/news/uc-davis-engineering-students-compete-build-corsi-rosenthal-air-purifiers; UC Davis, *The Corsi-Rosenthal Box: DIY Box Fan Air Filter for COVID-19 and Wildfire Smoke*, (March 15, 2022), https://aghealth.ucdavis.edu/news/corsi-rosenthal-box-diy-box-fan-air-filter-covid-19-and-wildfire-smoke.

[20] Inflation Reduction Act of 2022, Pub. L. No. 117-169; *see also* Rewiring America, *The Electric Explainer*, https://www.rewiringamerica.org/policy/inflation-reduction-act (last accessed Dec. 3, 2022).

from accessing the tax credits for lack of tax liability and prevented from taking advantage of rebates by the (real or perceived) lack of autonomy over homes they do not own. Driven by systemic oppression and racism, low-income and marginalized communities suffer the negative impacts of air pollution at disproportionately high rates.[21] Accordingly, EPA's incentive programs should target this vulnerable subset of residents by offering moment-of-purchase rebates to landlords who are improving ventilation and filtration systems or replacing gas stoves in low-income rental housing with electric alternatives. Notably, rebates should only be offered for electric stove alternatives that meet the UL 858 Standard for Electric Ranges, and EPA should encourage safe, high-efficiency induction stoves.[22] To maximize the impact of such a program, EPA could work with HUD to leverage contracts for federal housing assistance and ensure housing providers take advantage of rebates where available. Further, EPA could encourage proper disposal of outdated technology by offering special discounts on new electric appliances when landlords or low-income residents bring their old fossil fuel-fired systems to a recycling center.[23]

Workforce development is also crucial to improving indoor air quality. In particular, building inspectors should be trained to identify pollution sources and instruct building owners and operators about opportunities to reduce pollution and energy burden. EPA could provide training and certifications for healthy building inspectors, as well as grants to encourage local residents to become inspectors for their communities.[24] EPA could also provide training and certifications to healthcare workers, as they may be able to diagnose poor indoor air quality issues from their patients' health outcomes. In addition, workforce development programs must ensure that Black, Hispanic, and Latino workers are represented, giving equal opportunities in the form of paid pre-apprenticeships, and other workforce training. Priority should also be given to applicants who live within the particular community being supported.

Lastly, EPA could create and manage a grant program designed to support innovative approaches to improving indoor air quality and spread the word about systems that work. Across

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[21] American Lung Association, *Disparities in the Impact of Air Pollution*, https://www.lung.org/clean-air/outdoors/who-is-at-risk/disparities (last accessed Dec. 4, 2022); Harvard T.H. Chan School of Public Health, *Racial, Ethnic Minorities and Low-Income Groups in U.S. Exposed to Higher Levels of Air Pollution* (Jan. 12, 2022), https://www.hsph.harvard.edu/news/press-releases/racial-ethnic-minorities-low-income-groups-u-s-air-pollution/.

[22] The UL 858 Standard specifies a maximum surface temperature for the outside of the oven, helping to prevent burns, and limits cooktop temperature to prevent cooking fires. UL Standards and Engagement, *Household Oven and Range Standards: Helping to Mitigate the Risk of Burns*, https://ulse.org/standards-and-engagement/standards-matter/household-oven-and-range-standards-helping#:~:text=By%20specifying%20maximum%20surface%20temperature,with%20doors%2C%20handles%20or%20knobs (last visited July 19, 2022).

[23] Such a program could operate for a limited time, as the federal government's Car Allowance Rebate System or "Cash for Clunkers" program did.

[24] *See generally* ChangeLab Solutions, A Guide to Proactive Rental Inspections (2022), https://www.changelabsolutions.org/sites/default/files/2022-11/A-Guide-to-Proactive-Rental-Inspections_FINAL_20221031A.pdf.

the country, creative programmatic solutions to poor indoor air quality are being implemented. For instance, in Boston the Breathe Easy at Home project connects healthcare professionals with home inspectors via an online portal where they can collaborate to remediate in-home asthma triggers.[25] Because air quality issues vary depending on region, EPA should encourage diverse approaches. By tracking these approaches, EPA could develop expertise about what works and disseminate technical assistance to localities based on the unique problems faced by each jurisdiction.

3.3 In your opinion, over the longer term, how can ventilation, filtration and air cleaning improvements be prioritized and made standard practices in building design, construction, commissioning, renovation, and operations and maintenance efforts (*e.g.*, building code adoption, training or other efforts to sustain proper practices such as operation and maintenance of HVAC systems as designed, weatherization and other retrofit programs)?

Building codes are an increasingly popular tool to improve both indoor and outdoor air quality and reduce greenhouse gas emissions. Fortunately, the New Buildings Institute has published a set of decarbonization codes for both new[26] and existing buildings.[27] These resources set out redlined changes for the most common building code standards so jurisdictions can easily adopt policies requiring all-electric or electric-ready builds that support air quality improvements. In addition to endorsing all electric new builds and retrofits, EPA can use these standards to establish tiered incentives for jurisdictions or even developers that agree to abide by reach codes.

EPA should also consider endorsing and otherwise supporting jurisdictions and developers who commit to building performance standards related to indoor air quality, ventilation, and filtration. According to the Department of Energy, building performance standards (referred to in many states as 'energy codes') are "outcome-based policies and laws aimed at reducing the carbon impact of the built environment by requiring existing buildings to meet energy and/or greenhouse gas emissions-based performance targets."[28] However, in addition to lowering energy use and greenhouse gas emissions, building performance standards can be used to curtail other harmful pollutants by requiring air quality monitoring in existing buildings and setting timelines for achieving reduced pollution loads.[29] EPA should encourage jurisdictions to adopt building performance standards that specifically target indoor air quality issues common to their area.

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[25] City of Boston, *Breathe Easy at Home* (Apr. 7, 2022), https://www.boston.gov/departments/public-health-commission/breathe-easy-home.

[26] New Buildings Institute, Building Decarbonization Code (Aug. 2021), available at https://newbuildings.org/resource/building-decarbonization-code/.

[27] New Buildings Institute, Existing Building Decarbonization Code (Sept. 2022), available at https://newbuildings.org/resource/existing-buildings-decarbonization-code/.

[28] Dep't of Energy, *Building Performance Standards*, https://www.energycodes.gov/BPS (last accessed Dec. 4, 2022).

[29] *See* Institute for Market Transformation & International Well Building Institute, Building Performance Standard Module: Ventilation and Indoor Air Quality (Sept. 2021), https://www.imt.org/wp-

3.4 In your opinion, what is an effective approach for a building recognition program (*e.g.*, pledge campaign, performance tiers, certification program)?

In general, EPA should focus its incentive programs on buildings that deliver benefits to low-income and BIPOC communities. Discriminatory practices like red-lining and other manifestations of persistent, systemic racism and consistent strategic disinvestment have caused Black and Brown communities to experience higher-than-average levels of air pollution.[30] These environmental injustices drive health disparities such as the elevated asthma rates experienced by Black, Indigenous, and Puerto Rican children.[31] As climate change progresses, marginalized groups are projected to bear the most hazardous climate impacts despite having been systematically deprived of the resources necessary to protect themselves.[32] As stated earlier, these injustices include inadequate healthcare and inequitable access to quality housing. Given the injustice of this historic disinvestment and maltreatment, incentives and assistance should be targeted primarily at programs that are designed to assist these populations.

Fortunately, EPA has tools capable of helping the agency identify and reward programs that are making a difference in vulnerable communities. EPA's EJScreen tool could be used to assess the proportion of targeted properties that are situated in low-income census tracts, communities of color, and areas with high cumulative air pollution loads. EPA could also create performance-based grant or recognition programs that measure total emissions reductions for pollutants like nitrogen dioxide, carbon monoxide, and methane gas. Similarly, the agency could recognize organizations that are training members of disadvantaged communities to install and repair induction stoves, service heat pumps, conduct healthy home inspections, or otherwise contribute to the proliferation of cleaner air quality.

3.5/3.6 In your opinion, what are key characteristics of a building recognition program that would be needed to document credible efforts toward improved ventilation, filtration, and air cleaning in buildings? In your opinion, what quantifiable metrics or targets could be

content/uploads/2021/10/BPS-Ventilation-Brief-CW04.pdf (setting forth a model building performance standard for a graduated approach to improving ventilation and indoor air quality).

[30] Haley M. Lane et al., *Historical Redlining Is Associated with Present-Day Air Pollution Disparities in U.S. Cities*, 9 ENVTL. SCIENCE & TECH. LETTERS 345, 345-46 (March 9, 2022).

[31] Asthma and Allergy Foundation of America, *Asthma Facts and Figures* (updated April 2022) https://www.aafa.org/asthma-facts/; Mary Kreger et al., *An Underpinning of School Inequities: Asthma Absences and Lost Revenue in California*, J. SCHOOL HEALTH, Vol. 90 2020, at 1, 6; ASTHMA AND ALLERGY FOUNDATION OF AMERICA,ASTHMA DISPARITIES IN AMERICA: A ROADMAP TO REDUCING BURDEN ON RACIAL AND ETHNIC MINORITIES 11, 35-50 (2020), https://www.aafa.org/media/2743/asthma-disparities-in-america-burden-on-racial-ethnic-minorities.pdf.

[32] *See generally* EPA, CLIMATE CHANGE AND SOCIAL VULNERABILITY IN THE UNITED STATES:AFOCUS ON SIX IMPACTS (Sept. 2021), https://www.epa.gov/system/files/documents/2021-09/climate-vulnerability_september2021_508.pdf.

helpful in evaluating or assessing ventilation, filtration, and air cleaning parameters in a building?

Ideally, EPA's incentives will be based on continuous indoor air quality monitoring or comprehensive sampling that includes major indoor pollutants such as nitrogen dioxide, carbon monoxide, particulate matter, and VOCs like formaldehyde and benzene. Though EPA has not yet created indoor air quality standards for these pollutants, the World Health Organization published indoor standards for each in 2010.[33] In recent years, the WHO has revised its general air quality standards to be even more stringent, but even the 2010 standards outstrip existing National Ambient Air Quality Standards standards and would be a good interim goal for U.S. air quality.

To ensure participants are meeting their goals, smart filters and pollution sensors should be installed in new and retrofitted buildings. Monitoring is especially important for projects that aim to improve air quality because increasing ventilation can inadvertently introduce outdoor pollution to the indoor environment. This is especially concerning in light of increasing risks from wildfire smoke due to climate change. Technologies capable of comparing pollution levels inside and outside buildings and increasing or decreasing ventilation accordingly could significantly improve health outcomes. Yet, such technologies are not yet widely available or accessible for everyone. To incentivize research, design, and manufacturing of such systems, EPA could facilitate a competitive challenge similar to the Residential Cold Climate Heat Pump Challenge issued by the Department of Energy.[34] That program announced a major breakthrough earlier this year that will make residential heat pumps more widely accessible, lowering greenhouse gas emissions and reducing energy burden for millions of people.[35]

3.7 In your opinion, what changes would you recommend to the Clean Air in Buildings Challenge best practices document to improve public engagement and participation by a broad set of stakeholders?

To ensure equitable engagement, it is vital that public outreach is performed in overburdened communities. This means that public notices must not just be posted electronically but that local grassroots organizations within the community have the information to educate, engage, and empower residents to participate meaningfully in public comments and other opportunities for feedback. Even more, outreach should be language accessible and in various

[33] ROY HARRISON ET AL., WORLD HEALTH ORGANIZATION, WHO GUIDELINES FOR INDOOR AIR QUALITY: SELECTED POLLUTANTS (2010), https://www.ncbi.nlm.nih.gov/books/NBK138708/.
[34] Dep't of Energy, *Residential Cold Climate Heat Pump Challenge*, https://www.energy.gov/eere/buildings/residential-cold-climate-heat-pump-challenge (last accessed Dec. 5, 2022).
[35] Dep't of Energy, DOE Announces Breakthrough in Residential Cold Climate Heat Pump Technology (June 17, 2022), https://www.energy.gov/articles/doe-announces-breakthrough-residential-cold-climate-heat-pump-technology.

forms of communication from newspaper to broadcast to social media. Public engagement should include trusted stakeholders who work and may live in the community. Most importantly, public engagement should include residents and stakeholders who understand the community and are able to provide input on needed resources.

3.8 In your opinion, how might lessons from the COVID pandemic be useful for long-term efforts to improve ventilation, filtration, air cleaning and other indoor air quality parameters in the nation's building stock?

COVID exasperated existing health disparities within particular racial and ethnic communities. The pandemic highlighted inequities in certain populations as the deadly effects disproportionately affected low-income communities and communities of color. Researchers from the Centers for Disease Control and Department of Health and Human Services found that 78 percent of children who died from COVID between February and July 2020 were Black, Hispanic, or Indigenous.[36] Another study indicated the rate at which African American victims died from COVID was more than double the mortality rate for Caucasian and Asians.[37] As Dr. Fauci, Director of the National Institute of Allergy and Infectious Diseases and Chief Medical Advisor to the President, pointed out, "It's not that [African Americans] are getting infected more often. It's that when they do get infected, their underlying medical conditions…wind them up in ICU."[38]

A key takeaway from the pandemic is to ensure that all buildings, especially residences and schools where people spend a large amount of time, are having proper inspections to ensure toxins and other pollution are not exacerbating the already compromised breathing of marginalized, fenceline communities. Cumulative pollution exacerbates health impacts in marginalized communities. The 2018 American Journal of Public Health found that Black Americans are exposed to 50 percent more fossil fuel pollution than the population at large.[39] People of color and immigrants are also overrepresented in frontline communities, making them more vulnerable to COVID and other pathogens.[40] Low-income, Black and Brown households live next to industrial facilities, wastewater treatment plants, and congested highways at disproportionately high rates. This same polluted air causes lung disease, asthma, and early death

[36] Danae Bixler et al., *SARS-CoV-2—Associated Deaths Among Persons Aged <21 Years – United States, Feb. 12-July 31, 2020*, https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6937e4-H.pdf.
[37] Maritza Vasquez Reyes, *The Disproportional Impact of COVID-19 on African Americans*, 22 Health and Human Rights J. 299, 301 (2022).
[38] Lovelace Berkeley Jr., CNBC, *White House Officials Worry that Coronavirus is Hitting African Americans Worse than Others* (Apr. 7, 2021), https://www.cnbc.com/2020/04/07/white-house-officials-worry-the-coronavirus-is-hitting-african-americans-worse-than-others.html.
[39] Ihab Mikati et al., *Disparities in Distribution of Particulate Matter Emission Sources by Race and Poverty Status*, Amer. J. Pub. Health 108, available at https://doi.org/10.2105/AJPH.2017.304297.
[40] Hye Jin Rho et al., A Basic Demographic Profile of Workers in Frontline Industries 3-4 (Apr. 2020), https://cepr.net/wp-content/uploads/2020/04/2020-04-Frontline-Workers.pdf.

from these complications. Moreover, conditions like high occupancy density and smaller living spaces that are common in low-income housing also contribute to higher pollutant loads.[41]

During this public health crisis, households were asked to isolate themselves in their homes for safety. For overburdened communities, these homes were suffering from poor window insulation, malfunctioning appliances, poor sanitation, and more compounding not only their risk of contracting the virus but also being hospitalized due to the disease. Therefore, it is vital to ensure that inspections and maintenance of ventilation and filtration are made timely, benchmarking for safety standards are implemented, remediation is swift, and public education is accessible.

In sum, while we appreciate EPA's commitment to improving health outcomes through indoor air quality improvements, we urge the agency to consider the issue holistically and prioritize programs to benefit low-income and marginalized communities.

Thank you for your consideration,

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[41] DR. YIFANG ZHU ET AL., UCLAFIELDING SCHOOL OF PUBLIC HEALTH, EFFECTS OF RESIDENTIAL GAS APPLIANCES ON INDOOR AND OUTDOOR AIR QUALITY AND PUBLIC HEALTH IN CALIFORNIA 6,10 (2020), https://ucla.app.box.com/s/xyzt8jc1ixnetiv0269qe704wu0ihif7; BRADY ANNE SEALS & ANDEE KRASNER, HEALTH EFFECTS FROM GAS STOVE POLLUTION 14 (May 2020), https://www.psr.org/wp-content/uploads/2020/05/health-effects-from-gas-stove-pollution.pdf.