August 2, 2024

ASHRAE
180 Technology Parkway NW
Peachtree Corners, Georgia 30092

Re: Comment on ASHRAE Guideline 44P, "Protecting Building Occupants from Smoke During Wildfire and Prescribed Burn Events" Second Public Review Draft

Dear Technical Committee,

The American Lung Association appreciates the opportunity to comment on the second public review draft of Guideline 44P, "Protecting Building Occupants from Smoke During Wildfire and Prescribed Burn Events (the Guideline)." The Guideline highlights the importance of advancing public health and safety, particularly during environmental challenges like wildfires and prescribed burn events. In our comments on the first public review draft of the Guideline, we offered suggestions for improvement that have yet to be incorporated into the second draft, including the recommendations to use a more protective threshold for 24-hour fine particulate matter ($PM_{2.5}$) concentrations and more fully address how professionals can minimize other indoor pollutants. Further technical feedback and recommendations are included in the attached appendix.

The importance of clean indoor air cannot be overstated, especially considering people spend approximately 90% of their time indoors. As wildfire smoke, often driven by climate change, poses an increasing threat to lung health, the Guideline will serve as a useful document for professionals who aim to create safe environments that shield occupants from the harmful effects of outdoor pollutants. Wildfire smoke contains a toxic mixture of pollutants that can have devastating impacts on air quality and health. $PM_{2.5}$, the principal public health threat from exposure to wildfire smoke, can penetrate deep into the lungs and has been found to cause asthma attacks, heart attacks and stroke, adverse birth outcomes, lung cancer and even premature death. Some populations are more vulnerable to the health impacts of wildfire smoke, including those with lung or heart disease, older adults, children under 18, pregnant people and outdoor workers. The Lung Association acknowledges prescribed fire as an important tool to mitigate the risk of catastrophic wildfire. However, additional measures must be taken to protect people from smoke in both wildfire and prescribed fire events, as well as the impacts of overlapping health hazards.

In February 2024, the Environmental Protection Agency (EPA) strengthened the national ambient air quality standards (NAAQS) for annual $PM_{2.5}$ from 12 micrograms per cubic meter to 9 micrograms per cubic meter and decided not to revise the current 24-hour standard of 35 micrograms per cubic meter. Section *4.7 Indoor Air Quality* in the second draft of the Guidance erroneously references the outdated annual standard: "the annual $PM_{2.5}$ NAAQS is currently set at a level of 12.0 $\mu g/m^3$…at the time of publication of this guideline." While the Lung Association does not consider these standards to be directly applicable for indoor exposure, as they are designed to apply to ambient outdoor concentrations, we recognize their utility as a baseline for defining "clean air" in the absence of federal standards for indoor environments. However, we note that for outdoor exposure to particulate matter, even the revised standards fall short of levels necessary to adequately protect public health.

The Lung Association and other national health and medical organizations called on EPA to establish a primary annual $PM_{2.5}$ standard of 8 micrograms per cubic meter and a primary 24-hour $PM_{2.5}$ standard of 25 micrograms per cubic meter set at the 99th percentile to reflect the science-based recommendations of the Clean Air Scientific Advisory Committee.[1] These stronger standards would better meet the Clean Air Act's requirements through levels that are necessary to protect the public with an adequate margin of safety, including children, the elderly, people with respiratory or cardiovascular disease or diabetes and people already disproportionately burdened. We therefore recommend ASHRAE reference the recommendation of the Lung Association and other health and medical organizations that 24-hour $PM_{2.5}$ exposure of 25 micrograms per cubic meter is a more appropriate level to safeguard health.

As noted in our comments on the first draft of the Guideline, the air inside of a building should be protected from smoke through a two-pronged approach: the reduction of particulate matter coming in and the subsequent removal of particulate matter from air that has entered. We appreciate the emphasis on maintaining a tighter building envelope by keeping windows and doors closed and ensuring intake air is passed through adequate filtration at a rate that does not exceed untreated flows through inevitable leakage points. However, simply removing particulate matter from the air is not enough to render the air healthy to breathe; other elements of smoke are damaging to health and there are sources of chemicals within the home not addressed in the Guideline. Indeed, sealing the building envelope to keep smoke out will reduce ventilation and inevitably lead to some indoor-produced contaminants staying inside the building. Interventions against these contaminants are very briefly addressed in *6.2.6 Maintaining Space Conditioning and Reducing Odors*, but a stronger response on how professionals can abate inside pollutants to protect health should be developed.

We appreciate ASHRAE's emphasis on the importance of smoke readiness plans, active monitoring of indoor and outdoor $PM_{2.5}$ concentrations, improved indoor air filtration and dedicated clean air spaces. We also appreciate the consideration of multiple overlapping health threats, including extreme heat and smoke, which may pose significant health risks, especially for susceptible populations. We note that the Guideline is intended for larger buildings and not for single family homes and does not comprehensively cover the costs of implementing the recommendations. As more information becomes available on gaseous pollutants in wildfire smoke, including nitrogen oxides and volatile organic compounds, as well as secondary pollutants such as ozone, we urge ASHRAE to issue evidence-based guidance on reducing indoor exposure to these pollutants.

Thank you for ASHRAE's focus on protecting building occupants from the health impacts of smoke exposure from wildfire and prescribed fire events. The Guideline not only benefits the general population but also recognizes the vulnerabilities of individuals with lung diseases to ensure everyone has access to clean indoor air. We appreciate the opportunity to provide a second review and look forward to seeing the final Guideline. If you have any additional questions, please contact Natalia Reyes Becerra at Natalia.ReyesBecerra@lung.org.

Sincerely,

Deborah P. Brown
Chief Mission Officer

Appendix: Technical Feedback and Recommendations

RE: "**5.3.1 Selection of an Outdoor Design Concentration of PM2.5"**
Select outdoor design concentration of $PM_{2.5}$ based on Informative Annex ~~B~~A."

Response: Typographical error: "Appendix A" is intended.

RE: "**5.4.1 Removal Need Calculation**"

Response: The formatting should show subscripts as are used in Appendix F of ASHRAE Standard 62.1-2022 and the value for Ef, "the filter removal efficiency," should be used as a decimal fraction rather than as "%."

RE: "*Example*" shown on page 14.

Response: We suggest showing readers what variables are changeable, and which are dependent. For example, filter efficiency can be changed independently of other factors, presuming that the filter area is sufficient to handle the volumetric throughput, and the HVAC system is engineered to overcome the filter resistance. However, it is an identity that Voz = (1 – R)Vr, and users should be made aware of that. It can then be shown how altering things such as Voz, Ef, Fr, and R can produce a spectrum of possible outcomes. Furthermore, it can be shown that a back-calculation, beginning with some maximum target value for Cz, can be used to determine what combinations of some of these other values could be to ensure the indoor concentration does not exceed that target value.

We also note two small errors. First, the line for "Cz" has 0.9 in two places where it should read 0.963. Second, in the table, "Cz" is shown as 48.7 (the correctly rounded value), but as 48.6 in the blue box (a truncated value, but not correctly rounded).

RE: "*Example*" shown in "5.4.3 Filter loading calculation"

Response: (1) The claim by an editor that "during a wildfire event, filters will load with PM2.5 particle much faster than other particle sizes as discussed in Section 4" is not discussed in Section 4. Even if that would be the case, appropriate loading rates for each size class of particles should be used -- avoiding double-counting. (2) The mass distribution and concentrations of the atmospheric PM from wildfire assumed and used in the calculation are not stated as such in the variable list. (3) Actual values under conditions comparable to wildfire smoke exposure should be cited and used. (4) Rather than making specific, and perhaps unwarranted assumptions, the example should be more clearly shown as a set of estimates giving a range of values for the possible life of the filter, reflecting all of the unknown variables (filter type, flow rate, particle concentration, mass distribution and capture rate by particle size, DHC, multiplier for DHC, etc.). (5) The use of "2 x DHC" as the filter life endpoint deserves further scrutiny. It is important that reasonable filter effectiveness be maintained through the entire period of filter use, and it is questionable how much effectiveness remains at the "2 x DHC" endpoint. Simply, in real life, a case might well be made for the filter needing to be changed out before it reaches this point. In other words, a "squeeze every last bit out of a filter"-approach to understanding filter life is likely unrealistic to apply in real-life situations. (6) Rather, more useful than this calculation would be instructions given to building air quality managers as to how to monitor their filters' cumulative loading and evaluate ongoing effectiveness and airflow

resistance to make a good decision for when filter changeout is indicated. (7) The value used for ePM2.5 should be consistent with the Mass Removal Efficiency (Ef) value shown in Table 2 on page 12.

RE: "**5.5.1.2 Considerations for Sensor Placement"**

Response: Although it is reasonable to rely on data from well-maintained regulatory-grade monitors for an outdoor comparison value if the building location is quite nearby (e.g., within ~1 km), is subject to no obvious closer source of PM emissions, and is likely experiencing the same levels of PM concentrations, it is more likely than not that the nearest official PM monitors are quite some distance away from the affected building and may well not be expected to have comparable outdoor PM levels. More caution should be reflected here with respect to using data from such monitors, and particularly with respect to relying too much on "low-cost sensors" other than for ballpark estimates or, in the aggregate, for understanding area trends.

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[1] American Lung Association et al. (November 21, 2023). Comment on EPA's Proposed Rule in the Reconsideration of the National Ambient Air Quality Standards for Particulate Matter (Docket #EPA–HQ–OAR–2015–0072; RIN 2060–AV52).