October 9, 2023

ASHRAE
180 Technology Parkway NW,
Peachtree Corners, Georgia 30092

Dear Technical Committee:

Thank you for your work in developing Guideline 44P, "Protecting Building Occupants from Smoke During Wildfire and Prescribed Burn Events (“the Guideline).” The Guideline showcases your organization's commitment to advancing public health and safety, particularly in the context of indoor air quality during environmental challenges like wildfires and prescribed burn events. The American Lung Association has reviewed the document and offers overarching observations and suggestions for improvement. Specific remarks on individual sections (including probable typographical errors) are included in the attached appendix.

Overall, the importance of clean indoor air cannot be overstated, especially considering people spend approximately 90% of their time indoors. The Guideline will be a useful document for professionals who aim to create safe environments that shield occupants from the harmful effects of outdoor pollutants. It is comprehensive and anticipates an impressive number of physical engineering issues that could arise. 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.

Wildfire smoke poses an increasing threat to lung health as climate change renders wildfires more frequent and severe. As noted in the Guideline, wildfire smoke can have devastating impacts on air quality and health. $PM_{2.5}$ 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, and additional measures must be taken to protect people from smoke in both wildfire and prescribed fire events.

We appreciate that ASHRAE’s guideline include recommendations to:

- actively monitor indoor and outdoor $PM_{2.5}$ concentrations;
- improve indoor air filtration;
- create dedicated clean air spaces prior to wildfire season for older buildings, buildings where HVAC systems cannot accommodate minimum filter efficiency and for high-risk individuals;
- continuously update the Smoke Readiness Plan with lessons learned from each smoke event to improve emergency planning and response.

We likewise 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. 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. However, simply removing particulate matter from the air is not enough to render the air healthy to breathe; other elements of smoke that 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 in order to fully protect health should be developed.

The Guideline notes that the National Ambient Air Quality Standards (NAAQS) and the relevant science on which the standards are based are both reviewed periodically by EPA. 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. However, we do note that for outdoor exposure to particulate matter, the current standards are not strong enough. The Clean Air Act requires that these standards be set to protect the public with an adequate margin of safety. EPA is currently reviewing the NAAQS for particulate matter, and the Lung Association and other national health and medical organizations have called on the agency to significantly strengthen the standard. We requested a primary annual PM2.5 standard of 8 micrograms per cubic meter and a primary 24-hour PM2.5 standard of 25 micrograms per cubic meter set at the 99th percentile. These stronger standards would better meet the Clean Air Act's requirements by reflecting 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 use the Lung Association's recommendation at 8 micrograms per cubic meter or at least as protective as whatever is in effect as the current NAAQS year-round PM2.5 standard at the time of each instance of use of the ASHRAE guidance.

Thank you again for ASHRAE's focus on the health impacts of breathing in chemicals from wildfires and prescribed fire events. The Guideline not only benefits the general population but also recognizes the vulnerabilities of individuals with lung diseases. By catering to the needs of communities, ASHRAE demonstrates its dedication to equitable health solutions, ensuring that everyone has access to clean indoor air. If you have additional questions, please contact Brittany Meyer at Brittany.Meyer@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."

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: "**Table 1** - PM2.5 Removal Efficiency (Ef) for Various MERV Rated Filters."
RE: Table Note 1 and Table Note 2

Response: The values referenced in the notes should be recorded as having been interpolated, not extrapolated.

RE: "*Example*" shown on page 20.

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 that ensure the indoor concentration does not exceed that target value.

RE: "**5.4.3 Filter loading calculation"**

Response: The lefthand side of the Filter Life equation as shown is incorrect and the equation should be given as:

*Filter Life = (375g * 2) / (0.008222 g/min) = 1,520 hrs or 63 days*

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.

RE: "**5.5.1.3 Building Pressure Sensors**

Response: Correct phrasing is "… the pressure *difference* should be monitored …"

RE: "**5.5.2.1 Building Control System**" *et seq.*

Response: Properly intake / treat / exchange correct volume – in other words, intake air (passing through good filtration) should be at a rate that is sufficient to counteract, but not needlessly exceed, infiltration flows that would otherwise enter untreated through leakage points. In buildings with BAS, it would hopefully be possible to manage pressure differences to help inhibit infiltration if outdoor air is significantly polluted.

RE: "**5.5.4.1 Filters in New Construction**" *et seq.*

Response: Especially for the higher efficiency filters (MERV 13 through HEPA), care should be taken to ensure that the system is engineered to handle the pressure drop that may set up through such filters, especially once they begin to be loaded, and still delivers air flows needed in the impacted areas. With higher efficiency filters, even more attention is needed to ensure HVAC filter applications are maintained on a regular basis.