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NATIONAL OFFICE

55 W. Wacker Drive
Suite 1150
Chicago, IL 60601
Phone: (312) 801-7630

www.lung.org

American Lung Association

Comments to the U.S. Environmental Protection Agency on Standards of Performance for New Residential Wood Heaters, New Residential Hydronic Heaters and Forced Air Furnaces and New Residential Masonry Heaters

EPA Docket ID NO. EPA-HQ-OAR-2009-0734

May 5, 2014

For more information, please contact:
Janice Nolen, Assistant Vice President, National Policy
Janice.Nolen@Lung.org • 202-735-3355

The American Lung Association thanks the U.S. Environmental Protection Agency for the opportunity to provide comments on the proposed standards of performance for new residential wood heaters, including residential hydronic heaters and forced-air furnaces and residential masonry heaters. **We urge EPA to swiftly adopt rigorous, health-protective standards for all classes of residential wood heaters that require the best emission reduction systems**.

Residential wood heaters include open fireplaces, outdoor and indoor wood-fired boilers, indoor heaters, furnaces, masonry heaters and wood and pellet stoves. The U.S. Census (2011) reports that nearly two percent of all U.S. households use wood as a primary heat source. In 2006, one study estimated that approximately 14 to 17 million such devices were then in use in the United States (Johnson, 2006). Annual sales of outdoor wood boilers grew ten-fold between 2000 and 2005 – a rate suggesting that 500,000 outdoor wood boilers may have been in use by 2010 (NESCAUM, 2006; New York State Office of the Attorney General, 2008).

Emissions from Wood-Burning Threaten Public Health

Burning wood produces emissions that are widely recognized as harmful to human health. Emissions from wood smoke, discussed below, include particulate matter, carbon monoxide, nitrogen oxides, volatile organic compounds, hazardous air pollutants and carcinogens. Many of these emissions can occur in both indoor and outdoor environments (Naeher et al., 2007). Wood smoke is also a significant source of many of these pollutants, especially primary particulate matter. New source performance standards should recognize the diversity and toxicity of these wood smoke-related air pollutants.

Particulate Matter

The EPA recognized wood smoke as a major source of particulate matter emissions in the 2009 *Integrated Science Assessment for Particulate Matter* (PM ISA, 2009). The PM ISA reports that emissions from residential wood burning comprised seven percent (7 %) of the source of anthropogenic emissions of primary $PM_{2.5}$ in 2002 (PM ISA, 2009). Wood smoke particles generally fall under one micrometer (1 µm) in size, making them largely ultrafine particles. Because of their size, wood smoke particles can be transported hundreds of kilometers from the source (Naeher et al., 2007). The EPA concluded in the PM ISA that fine particulate matter cause premature death and cardiovascular disease and likely causes respiratory harm (PM ISA, 2009). The PM ISA reported studies that specifically found wood smoke and vegetative burning associated with an increased risk of cardiovascular mortality (Mar et al., 2000), as well as increased emergency department visits from cardiovascular disease (Sarnat et al., 2008) and respiratory diseases (Schreuder et al., 2006).

Since the EPA completed work on the PM ISA, additional research has provided more information about particles from wood smoke. A major review (Bølling et al., 2009) found evidence that combustion conditions, including moisture content, insufficient air, and wood constituents, can impact the characteristics of the resulting particles. Bølling et al., (2009) found the lowest particle emissions when burning incorporates high temperatures, plentiful supply of oxygen and ample mixing of the air and gases.

In late 2013, the International Agency for Research on Cancer, part of the World Health Organization, concluded that particulate matter could cause lung cancer. The IARC reviewed the most recent research and reported that the risk of lung cancer increases as the particle levels rise (WHO, 2013).

Wood smoke from existing unregulated outdoor wood boilers has been found to create $PM_{2.5}$ concentrations that greatly exceeded the $PM_{2.5}$ 24-hour National Ambient Air Quality Standard (Johnson, 2006).

Carbon Monoxide

Wood smoke is a primary source of carbon monoxide, as identified in both the EPA's 2010 *Integrated Science Assessment for Carbon Monoxide* (CO ISA, 2010) and the Agency for Toxic Substances and Disease Registry (ATSDR) 2012 *Toxicological Profile of Carbon Monoxide* (ATSDR, 2012). Carbon monoxide emissions from wood smoke add to the outdoor levels of carbon monoxide, as well as increasing indoor concentrations (Naeher et al., 2007).

High, short-term levels of carbon monoxide can be fatal, and contribute to over 20,000 nonfatal emergency room visits each year in the U.S (CDC, 2008; ATSDR, 2012). The CO ISA concluded that short-term ambient levels of carbon monoxide are likely to cause cardiovascular morbidity. The CO ISA also concluded that the evidence suggests that short-term exposure to outdoor levels of carbon monoxide may cause premature death, adverse birth outcomes and developmental effects, harm to the central nervous system and respiratory harm. The ATSDR concluded that even low levels of exposure to carbon monoxide can impact the cardiovascular and nervous system, as well as the fetus and the newborn. Consequently, the ATSDR concludes that even low levels of carbon monoxide cannot be assumed to be acceptable:

> Although there may be an exposure level that can be tolerated with minimal risk of adverse effects, the currently available toxicological and epidemiological data do not identify such minimal risk levels (ATSDR, 2012).

Nitrogen oxides

The EPA recognized wood smoke, including residential wood burning, as a source of nitrogen oxides in the 2008 *Integrated Science Assessment of Oxides of Nitrogen—Health Criteria* (NOx ISA, 2008). The NOx ISA estimated that residential wood burning produced 40,000 metric tons of nitrogen oxides in 2002 (Table 2.2-1). The NOx ISA identified residential wood burning as a source of indoor air levels of nitrogen oxides. As discussed in the NOx ISA, the Yale Childhood Asthma Study measured indoor levels of NOx by heat source in homes of 888 nonsmoking mothers in Connecticut and Virginia. Reporting NOx levels at the 90th percentile levels, Triche et al: (2005) found homes with fireplaces had two week average concentrations of 80 ppb NOx and homes with wood stoves had two-week average concentrations of 52 ppb NOx. Each hour of use of fireplaces, though not wood stoves, were linked in increased cough and sore throat. A review article calculated that using fireplaces in these homes for four hours would be expected to increase the risk of such symptoms by 16-20 percent (Naeher et al., 2007).

Volatile organic compounds, including carcinogens and HAPs

Wood smoke contains "many hundreds" of hydrocarbons and oxygenated organics, many of which are carcinogens and hazardous air pollutants (Naeher et al., 2007). Benzene, formaldehyde, and 1,3-butadiene are recognized as known human carcinogens (HHS, 2011). Long-term exposures to benzene can cause leukemia, a blood cancer, and other blood disorders such as anemia and depressed lymphocyte count in blood. Exposure to formaldehyde can also cause chronic bronchitis and nasal epithelial lesions. A recent review of the research found evidence that formaldehyde may increase the risk of asthma, particularly in the young (McGwin et al., 2010).

Wood smoke contains at least 26 pollutants specified in the Clean Air Act as hazardous (Naeher et al., 2007). Some include the carcinogens listed above but others have non-carcinogenic impacts. These gases can also irritate the eyes, skin, and respiratory tract, impair lung function, and affect vital organs.

Polycyclic aromatic hydrocarbons (PAHs)

Wood smoke is estimated to contain over 20 different polycyclic aromatic hydrocarbons, or PAHs (Naeher et al., 2007). A recent review identified some of the most abundant PAHs in wood smoke as naphthalene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene and pyrene. In addition two others, benzo(a)pyrene and fluoranthene are carcinogens (Bølling et al., 2009).

Many People, including Children, Face Higher Risk

Many people are more susceptible to harm from emissions from wood smoke. Large populations face higher risk: those at vulnerable life stages, including fetuses, children, teens and adults over age 65; those who have chronic lung diseases, such as asthma and chronic obstructive pulmonary disease; those who have heart disease, high blood pressure, coronary artery disease and congestive heart failure; diabetics; and those with low incomes (PM ISA, 2009).

Children face special risks from air pollution because their lungs are growing and because they are so active. Just like the arms and legs, the largest portion of a child's lungs will grow long after he or she is born. Eighty percent of their tiny air sacs develop after birth. Those sacs, called the alveoli, are where the life-sustaining transfer of oxygen to the blood takes place. The lungs and their alveoli aren't fully grown until children become adults (Dietert et al., 2000). In addition, the body's defenses that help adults fight off infections are still developing in young bodies. Children have more respiratory infections than adults, which also seems to increase their susceptibility to air pollution (WHO, 2005).

The Phase 1 and Final Standards Must Protect Public Health

Woodstoves, pellet stoves and single burn rate stoves. The EPA has, in both approaches, proposed a final standard of 1.3 g/hr for all devices at the completion of the phase-in of the standards. The Lung Association supports that as a final standard for all new woodstoves, pellet stoves and single burn rate stoves, although. However, we urge EPA to strengthen the Phase 1 standards (compliance within six months after promulgation) for these devices to the 2.5 g/hr that can currently be met by catalytic stoves currently in use in Washington State, instead of the far weaker 4.5 g/hr proposed in both approaches.

The Lung Association opposes allowing new devices that currently have no standards to meet a far weaker standard in the initial phase than much of the industry can currently meet. If EPA's proposed initial standard of 4.5 g/hr is adopted, manufacturers will continue to produce units that emit far more and are far less efficient than current technology allows. These devices would then be in use for years to come.

The Lung Association supports grouping all such stoves in one emissions standard category to simplify review and compliance procedures and to eliminate loopholes that would inadvertently exempt units. However, the standards for emissions in the first phase should not be based on what is currently in use in the weakest category among these groupings.

Hydronic heaters and forced air furnaces. The Lung Association supports EPA's proposal to require all hydronic heaters and forced air furnaces to meet a Phase 1 standard of .32 lb/MM BTU within 60 days after promulgation of the standard and a final standard of 0.06 lb/MM BTU.

Mandatory standards on hydronic heaters are long overdue. First marketed as outdoor heaters, these devices have a history of spewing unrestricted emission into neighborhoods (NESCUAM, 2006). In recent years, EPA reports, they have grown as indoor heating devices. In 2007, the hydronic heater manufacturers agreed to a voluntary program that committed them to marketing heaters that met that standard. Seven years later EPA estimates that 17 of the 36 manufacturers have each marketed at least

one device that meets that voluntary standard (79 Federal Register 6359). Therefore, the sixty-day deadline for meeting a standard that they agreed to seven years ago should pose no problem to the industry.

The industry should have no problem meeting the final standard as well, and in much less time. EPA notes that two U.S. models currently meet that standard, as do over 50 European models. Use of European testing methods may also allow these manufacturers to use the technology currently in use in Europe.

Masonry heaters. The Lung Association supports the proposed standard for masonry heaters. Since these are single built devices, the EPA's decision that the standards should apply immediately upon promulgation is wise.

Test methods. All test methods should replicate real-life experiences. Test methods requiring the use of cord wood from a variety of wood species more typically used across the nation rather than solely crib wood or dimensional lumber. The sole use of crib wood or dimensional lumber misrepresents the emissions that households will likely experience as they rely on local wood that is often less dense and produce higher emissions. Strong standards may also encourage the use of more standardized pellets that burn more efficiently and emit less.

The Lung Association supports EPA adopting existing European Union EN303-05 test methods and systems, as well as the partial thermal storage test measure developed by Brookhaven National laboratory, as these are proven test methods and will speed up the implementation. For the same reason, the Lung Association supports the use of the changes to the emission testing for hydronic heaters approved by the voluntary partnership program stakeholders in June 2011.

The Lung Association urges that the installation requirements for these units specifically require that heater be installed with specific volume and configuration of heat shortage or other equipment used in the certification test. Such installation requirements are needed to ensure that these devices will be more likely to be installed appropriately even where state or local building codes vary.

EPA should Include Fireplaces in the Final Standards

The Lung Association also urges the EPA to include emission limits on fireplaces in the final standards. The proposed standards apply to all residential wood-burning devices except new indoor fireplaces, a significant omission. Fireplaces are installed in new and remodeled homes throughout the nation. Once installed, they will emit unlimited pollutants in every location for the lifetime of the house, which can be for generations in the future.

The EPA should also consider the impact on indoor air quality in the decision on fireplaces. The Yale Childhood Asthma Study of indoor air quality in homes in Connecticut and Virginia found that homes with fireplaces had average nitrogen oxides concentrations that were higher than are considered safe. Each hour of fireplace use increased cough and sore throat in these nonsmoking mothers (Triche et al, 2005).

The Lung Association also calls on EPA to develop and propose regulations for heaters that use other fuels besides wood, including coal and other biomass fuels such as corn and switch grass.

Proposed Timing of Final Standards Remains Much Too Long Under Both Approaches

The American Lung Association opposes the length of time EPA proposes to give industry to comply with the stronger, final standards under both approaches. For Phase 1, the Lung Association supports the proposed EPA timeline, including six months for new stoves and 60 days for hydronic heaters and forced air furnaces. However, the Lung Association recommends shortening the time for implementation of the final, Phase 2 standards to no later than three years after the final rule is adopted, February 3, 2018.

The EPA has neglected its responsibility to update the standards for new devices for 17 years, increasing the need to provide the best systems of emission reduction as soon as possible, not five or eight years down the road. Normally, new source performance standards must be met immediately by the affected industry. EPA argues that the timing addresses concerns over certification testing and approval "logjams," but other industries that market to consumers manage with much shorter time to compliance. For example, EPA adopted the Tier 3 standards for the motor vehicle industry on March 3, 2014 and directed the industry to comply by model year 2017. That means that the vehicles for sale in the fall of 2016 must be ready to meet the standards just over two years after EPA adopted the regulation, a timetable the motor vehicle industry could meet. The motor vehicle industry is every bit as complex with as many models as the residential wood-burning device market, each requiring certification and approval. Yet the EPA proposal would provide the wood device industry with two to four times longer to comply with these long-overdue changes.

Adding to the inexplicably long time for compliance with an already 18-year past due rule, the technology needed to meet these standards exists and is in use today. The European System shows that comparable units are possible and produce greater efficiency in wood use and heat production (Musil-Schläffer et al., 2010). Furthermore, many American manufacturers produce many product lines that already meet these standards.

For those reasons, the American Lung Association sees no reason why the effective date of the final standards should be any later than February 3, 2018.

EPA should explicitly require indoor CO monitors for these devices

As noted earlier, burning wood can produce high levels of carbon monoxide that can place particular risk to the public. EPA has noted that it lacked sufficient information on carbon monoxide emissions while preparing the proposed rule to set a carbon monoxide standard, but that it would seek data for such a standard. The Lung Association strongly supports EPA establishing a specific carbon monoxide emissions standard for these devices, but urges that such a standard must be based not simply on what the best units can currently do, but on protecting human health.

Whether EPA adopts a carbon monoxide standard in the final rules, EPA should explicitly require indoor carbon monoxide monitors to as a critical safety component for heaters installed indoors or in enclosed areas where normal maintenance and operation, including regularly supplying fuel, takes place. Carbon monoxide poisoning occurs all too frequently indoors and requirements to monitor have helped the public awareness of the risks to health (Iqbal et al., 2012). The Lung Association supports EPA's consideration of such a step that would reduce carbon monoxide poisoning.

EPA Needs To Take Action Now

The EPA set the current NSPS for wood-burning devices over a quarter century ago. That year, 1988, was six years before the first of the landmark studies that taught that particulate matter can be deadly. Since then, research into the pollutants from wood-burning has grown rapidly, creating abundant

evidence that the standards are woefully out of date. Technology to reduce and control emission has expanded the ability to protect human health.

The American Lung Association calls on the EPA to move swiftly to adopt rigorous, health-protective standards for all classes of residential wood heaters. These standards should require the best emission reduction systems that reflect real-world performance of residential heating devices. Until that happens, these devices will continue to be built and installed, compounding the outdoor problem and causing people to mistakenly bring harmful sources of pollution directly into their homes. That reality will make it ever harder to protect the health of the public. We strongly urge the EPA to adopt standards that protect public health.

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