

U.S. Department of Energy  
1000 Independence Ave., SW  
Washington, DC 20585

Increased Efficiency Standards for Non-Weatherized Gas Furnaces and Mobile Home Furnaces  
EERE-2014-BT-STD-0031  
October 6, 2022

Thank you for the opportunity to comment on new standards related to consumer gas-powered furnaces. The undersigned sixteen health and science organizations support the new proposed standard. Although we support the eventual elimination of gas use within the home, during this transition, this rule will reduce pollutants that harm human health, reduce climate change emissions, and save all customers (including those in disadvantaged and low - income communities) money.

Gas heating appliances account for about two-thirds of household gas use and related emissions<sup>1</sup>. Nearly half of U.S. homes are heated with a gas or propane furnace<sup>2</sup>. Many homes use inefficient furnaces which cause excess methane, carbon dioxide, and nitrogen dioxide emissions into the indoor and outdoor environment.

While gas furnaces are vented outside, that does not prevent backdrafting of these pollutants back into the home when indoor air pressure is reduced due to kitchen exhaust hoods or bathroom ventilation fans. Additionally, venting these pollutants outdoors can cause community-wide harm, particularly among low-income communities and communities of color who are already saddled with increased levels of ambient air pollution<sup>3</sup>.

### **The Proposed Standard Will Protect Human Health**

Gas furnaces are a source of pollution that has been shown to harm human health. We present a large body of research on the various health impacts of exposure to methane gas and the chemicals that result when methane is burned within the home and nearby places.

A significant amount of evidence on the detrimental health effects of exposure to air pollution shows that burned methane (natural) gas (mostly nitrogen dioxide) contributes to premature mortality and increased risk for illness including ischemic heart disease, stroke, COPD, lung cancer, type 2 diabetes, and lower-respiratory infections<sup>4,5</sup>. There is a growing body of evidence

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<sup>1</sup> Energy Information Administration (EIA), Residential Energy Consumption Survey (2020). Table HC <https://www.eia.gov/consumption/residential/data/2020/hc/pdf/HC%206.1.pdf>

<sup>2</sup>Berry C. Space heating and water heating account for nearly two thirds of U.S. home energy use. U.S. Energy Information Administration. Published November 2018. <https://www.eia.gov/todayinenergy/detail.php?id=37433>

<sup>3</sup>Wilhelm M, Qian L, Ritz B. Outdoor air pollution, family and neighborhood environment, and asthma in LA FANS children. *Health & Place*. 2009;15(1):25-36. doi:10.1016/j.healthplace.2008.02.002

<sup>4</sup>Singer BC, Pass RZ, Delp WW, Lorenzetti DM, Maddalena RL. Pollutant concentrations and emission rates from natural gas cooking burners without and with range hood exhaust in nine California homes. *Building and Environment*. 2017;122:215-229. doi:10.1016/j.buildenv.2017.06.021

<sup>5</sup>Roda C, Kousignian I, Guihenneuc-Jouyaux C, et al. Formaldehyde Exposure and Lower Respiratory Infections in Infants: Findings from the PARIS Cohort Study. *Environmental Health Perspectives*. 2011;119(11):1653-1658. doi:10.1289/ehp.1003222

showing an association between long-term exposure to air pollution and adverse birth outcomes. Short term exposure to high levels of air pollution can exacerbate asthma and cardiopulmonary symptoms<sup>6</sup>.

Indoor exposure to nitrogen dioxide from gas appliances can exacerbate asthma symptoms and wheeze in children and may increase lower respiratory tract illnesses and reduce lung function in children. Other chemicals found in gas emissions are associated with upper respiratory infections and cough<sup>7</sup>.

#### *Uncombusted Methane Gas Risks*

Even when uncombusted, methane gas and leaks from methane gas appliances & pipelines pose a risk to human health. A recent study by the Center for Climate, Health, and the Global Environment at Harvard T.H. Chan School of Public Health, PSE Healthy Energy, Atmospheric and Environmental Research (AER), Gas Safety Inc., Boston University, and Home Energy Efficiency Team (HEET) found that consumer-grade natural gas contains varying levels of at least 21 different hazardous air pollutants, including benzene, toluene, ethylbenzene, xylene, and hexane. The researchers also found that these leaks can be undetectable by smell, with small leaks up to methane concentrations of 20 parts per million void of odorant concentrations necessary for sensory detection<sup>8</sup>.

In addition, methane is a potent greenhouse gas, driving health harms related to climate change including increased levels of particulate matter (driven by wildfire smoke), ozone (driven in part by increased heat), infectious disease, heat-related illness and more.

#### *Combusted Methane Gas Increases Risk of Heart Disease and Stroke*

When methane gas is burned, the primary pollutants produced are nitrogen dioxide and carbon monoxide. Carbon Monoxide is a damaging air pollutant that can cause headache, fatigue, unconsciousness and even death<sup>9</sup>. Nitrogen dioxide is a dangerous pollutant in its own right, and it is also a precursor to PM<sub>2.5</sub>, (particulate matter smaller than 2.5 microns in diameter). There is a large body of evidence that particulate matter damages the respiratory and the cardiovascular system. When inhaled, PM<sub>2.5</sub> settles on the walls of the alveoli in the lungs which sets off a cascade of inflammatory reactions in the body. These reactions affect proper heart function and can cause arrhythmia and increase the risk of heart attacks. The combustion of methane can also produce ultrafine particulate matter—also known as PM<sub>0.1</sub>. Ultrafine particulate matter is so small that it translocates into the bloodstream through the lungs or sinus

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<sup>6</sup> Tiotiu AI, Novakova P, Nedeva D, Chong-Neto HJ, Novakova S, Steiropoulos P, Kowal K. *Impact of Air Pollution on Asthma Outcomes*. Int J Environ Res Public Health. 2020 Aug 27;17(17):6212.

<sup>7</sup> Weiwei Lin, Bert Brunekreef, Ulrike Gehring, *Meta-analysis of the effects of indoor nitrogen dioxide and gas cooking on asthma and wheeze in children*, Int J of Epidemiology, 2013; 42 (6): 1724–1737

<sup>8</sup>Michanowicz DR, Dayalu A, Nordgaard CL, 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. *Environmental Science & Technology*. 2022;56(14):10258-10268.

<sup>9</sup>US EPA,OAR. Carbon Monoxide's Impact on Indoor Air Quality | US EPA. US EPA. Published July 31, 2014. <https://www.epa.gov/indoor-air-quality-iaq/carbon-monoxides-impact-indoor-air-quality>

vasculature and can cross the blood-brain barrier. This dramatically increases the risk of stroke and heart attack when the matter accumulates in brain tissue and heart tissue, respectively<sup>10</sup>.

#### *Combusted Methane Gas Increases Risk of Ozone-Related Illness*

Nitrogen dioxide is also a precursor to ozone, which is created by chemical reactions between volatile organic compounds and oxides of nitrogen in the presence of sunlight. Ozone reacts with and damages organic matter such as plant foliage, the human airway and other lung tissues. Exposure to ozone causes irritation and inflammation of the lungs, and leads to coughing, wheezing, worsening of asthma and lowered resistance to lung infections. Physical activity during peak ozone periods increases exposure and the likelihood of symptoms. Long-term exposure to higher ozone levels can permanently reduce lung function<sup>11</sup>. These health effects of ozone contribute to increased emergency department visits, hospital admissions and deaths on days with higher ozone concentrations, and to increased mortality associated with chronic ozone exposure<sup>12</sup>.

#### *Combusted Methane Gas Increases Risk of Asthma*

Nitrogen dioxide is a primary air pollutant produced by the combustion of methane gas. The relationship between both short-term and long-term nitrogen dioxide exposure and the development of childhood asthma is well-documented and acknowledged by the U.S. EPA<sup>13</sup>. This acknowledgement came from the thorough review of studies showing that small increases in nitrogen dioxide concentration affected childhood respiratory function. For example, a 2013 study found that for every 5-ppb increase in nitrogen dioxide, the risk of wheeze and need for medication increased<sup>14</sup>. A meta-analysis from the same year found that children's risk of wheeze increased by 15 percent for every 15-ppb increase in nitrogen dioxide concentration<sup>15</sup>. Low-income, Black, and Hispanic children are at higher risk of asthma exacerbation and respiratory symptoms from methane gas pollution than their high-income and White counterparts due to often living in historically disinvested communities with higher levels of ambient outdoor air pollution and poorly maintained housing stock and building appliances<sup>16</sup>. Additionally, older adults are also at risk from prolonged nitrogen dioxide exposure. A recent

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<sup>10</sup>US EPA. Health and Environmental Effects of Particulate Matter (PM). US EPA. Published May 9, 2019. <https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm>

<sup>11</sup>Calderón-Garcidueñas L, Mora-Tiscareño A, Fordham LA, et al. Respiratory damage in children exposed to urban pollution. *Pediatric Pulmonology*. 2003;36(2):148-161. doi:10.1002/ppul.10338

<sup>12</sup>Silverman RA, Ito K. Age-related association of fine particles and ozone with severe acute asthma in New York City. *Journal of Allergy and Clinical Immunology*. 2010;125(2):367-373.e5. doi:10.1016/j.jaci.2009.10.061

<sup>13</sup>*Integrated Science Assessment (ISA) For Oxides of Nitrogen – Health Criteria* (Final Report, 2016). US Environmental Protection Agency, Washington, DC, EPA/600/R-15/068, 2016, Table ES-1, p. Lxxxii, <https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=310879>.

<sup>14</sup>Belanger K, Holford TR, Gent JF, Hill ME, Kezik JM, Leaderer BP. Household Levels of Nitrogen Dioxide and Pediatric Asthma Severity. *Epidemiology*. 2013;24(2):320-330. doi:10.1097/ede.0b013e318280e2ac

<sup>15</sup>Lin W, Brunekreef B, Gehring U. Meta-analysis of the effects of indoor nitrogen dioxide and gas cooking on asthma and wheeze in children. *International Journal of Epidemiology*. 2013;42(6):1724-1737. doi:10.1093/ije/dyt150

<sup>16</sup>Hansel NN, Breyse PN, McCormack MC, et al. A Longitudinal Study of Indoor Nitrogen Dioxide Levels and Respiratory Symptoms in Inner-City Children with Asthma. *Environmental Health Perspectives*. 2008;116(10):1428-1432. doi:10.1289/ehp.11349

epidemiological study of a large cohort of Medicare beneficiaries found long-term exposure to extremely low levels of NO<sub>2</sub> was associated with a higher risk of mortality among older adults<sup>17</sup>.

### **The Proposed Standard Will Reduce Climate-Change-Driving Emissions**

By requiring furnaces to use about 15% less energy, the proposed standard would cut 373 million metric tons of carbon emissions and 833 thousand tons of NO<sub>x</sub> emissions over 30 years of sales, reducing pollution that harms the environment and human health<sup>18</sup>. This reduction in carbon emissions is crucial to the stability of our global climate and the integrity of human health. The Intergovernmental Panel on Climate Change (IPCC) reported that to keep warming below 1.5°C and avoid the worst effects of climate change, global greenhouse gas emission will need to peak by 2025, CO<sub>2</sub> emissions must decrease by 48% by 2030 compared to 2019 levels, and methane emissions must decrease by 34%. If emissions continue to rise and warming is not capped at 1.5°C, rising temperatures, more extreme weather, rising sea levels and environmental degradation will both create new and exacerbate existing public health threats<sup>19</sup>.

The proposed standard for gas furnaces will help reduce the direct health effects of air pollution like cardiovascular and respiratory illness as well as curb the health effects of climate change like extreme heat, population displacement, and injury & fatality due to natural disasters. Improving the efficiency of building heating will keep both humans and the planet healthy.

### **The Proposed Standard Will Save Consumers Money**

Households with a basic (non-condensing) gas furnace face annual average heating bills of nearly \$700<sup>20</sup>. Those who live in older, draftier homes or in colder climates can have much higher bills. High heating bills can force a terrible choice between paying for heat and other necessities such as food and medicine. These bills particularly strain low-income households, which pay three times as much of their incomes on energy costs than non-low-income households and are disproportionately Black, Hispanic, and Native American. In 2022, rising residential gas prices are making this strain even worse. The proposed standard would save consumers about \$500 on average over the life of a furnace<sup>21</sup>.

In summary, by significantly increasing the efficiency of gas furnaces, the proposed standard will phase out older technology in favor of more-efficient condensing technology. The transition

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<sup>17</sup>Qian Y, Li H, Rosenberg A, et al. Long-Term Exposure to Low-Level NO<sub>2</sub> and Mortality among the Elderly Population in the Southeastern United States. *Environmental Health Perspectives*. 2021;129(12). doi:10.1289/ehp9044

<sup>18</sup>U.S. Department of Energy, Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Residential Furnaces. June 2022. Table 13.2.1 and 13.2.2

<sup>19</sup>IPCC, 2022: Summary for Policymakers. In: *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [P.R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, S. Some, P. Vyas, R. Fradera, M. Belkacemi, A. Hasija, G. Lisboa, S. Luz, J. Malley, (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA. doi: 10.1017/9781009157926.001

<sup>20</sup>U.S. Department of Energy, Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Residential Furnaces. June 2022. Table 8.7.1 and 8.7.5.

<sup>21</sup>U.S. Department of Energy, Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Residential Furnaces. June 2022. Table 8.7.1 and 8.7.2

will improve human health, combat climate change, and reduce utility bills. We strongly urge you to adopt the proposed increased standard.

Thank you for the opportunity to comment.

Allergy & Asthma Network  
Alliance of Nurses for Healthy Environments  
American Geophysical Union  
American Lung Association  
American Public Health Association  
American Thoracic Society  
Asthma and Allergy Foundation of America  
Children's Environmental Health Network  
Climate for Health/ecoAmerica  
National Carbon Monoxide Awareness Association  
Oregon Physicians for Social Responsibility  
Physicians for Social Responsibility  
Physicians for Social Responsibility Florida  
Physicians for Social Responsibility Pennsylvania  
Texas Physicians for Social Responsibility  
Washington Physicians for Social Responsibility