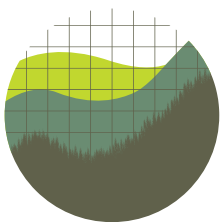




The Emissions in the Kitchen

*How the Consumer Product Safety Commission Can
Address the Risks of Indoor Air Pollution from Gas Stoves*



Institute for
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Introduction

Long marketed as an essential tool for serious home cooks,¹ gas stoves² are found in over a third of American homes.³ Many stove owners are likely already aware of the fire hazards posed by gas leaks and improperly supervised flames.⁴ Less familiar—and more insidious—are the significant health risks associated with indoor air pollution from these appliances.

Stoves that burn natural gas emit a host of pollutants inside the home, including nitrogen dioxide (NO₂) and fine particulate matter (PM_{2.5}).⁵ Within just a few minutes of cooking, the resulting pollutant concentrations can exceed levels that the U.S. Environmental Protection Agency (EPA) and the World Health Organization (WHO) have deemed unsafe and linked to respiratory illness, cardiovascular problems, cancer, and other serious health conditions.⁶ Children, low-income people, people of color, and people with pre-existing health conditions are at an especially high risk of adverse health effects from gas stoves.⁷

While EPA limits pollution levels outdoors, it disclaims authority to regulate indoor air quality.⁸ The Consumer Product Safety Commission (CPSC), however, is tasked with ensuring that consumer products, including gas stoves, do not pose an unreasonable risk of injury.⁹ Accordingly, the CPSC can and should take action to reduce health harms resulting from indoor air pollution caused by gas stove emissions.

Part I of this report reviews the evidence regarding the direct health risks that indoor gas stove emissions pose to stove users and other members of their households.¹⁰ Part II identifies steps the CPSC could take to address these risks, using its existing statutory authority. Specifically, we recommend that the CPSC (1) facilitate voluntary performance standards or promulgate mandatory performance standards for new gas stoves and range hoods, (2) require warning labels on gas stoves, and (3) create accessible public-education materials regarding the dangers of gas stoves.

¹ See *Rediscovering the Joy of Home Cooking*, SE. GAS (Sept. 1, 2021), <https://southeastgas.com/news/rediscovering-the-joy-of-home-cooking/> (“For the serious home cook, natural gas stoves and ovens offer pro-style results.”); Rebecca Leber, *How the Fossil Fuel Industry Convinced Americans to Love Gas Stoves*, MOTHER JONES (June 17, 2021), <https://www.motherjones.com/environment/2021/06/how-the-fossil-fuel-industry-convinced-americans-to-love-gas-stoves/>.

² In this report, “gas stove” refers to both the gas stovetop and the gas oven.

³ Of 118.2 million homes surveyed, 35.2 million used stoves fueled by natural gas, 5.5 million stoves fueled by propane, and 0.9 million stoves with dual fuel. *Residential Energy Consumption Survey: Table HC3.6 Appliances in U.S. Homes by Climate Region*, 2015, U.S. ENERGY INFO. ADMIN. (2017), <https://www.eia.gov/consumption/residential/data/2015/hc/php/hc3.6.php>.

⁴ See *Stand by Your Pan*, CPSC, <https://www.cpsc.gov/safety-education/safety-guides/fire/stand-your-pan> (last visited Mar. 9, 2022).

⁵ See *infra* Section I.A.

⁶ See *id.*; Eric D. Lebel et al., *Methane and NO_x Emissions from Natural Gas Stoves, Cooktops, and Ovens in Residential Homes*, 56 ENV'T SCI. & TECH. 2529, Supporting Information Figure S11 (2022), <https://doi.org/10.1021/acs.est.1c04707> (finding that gas stoves could exceed WHO standards for NO₂ within approximately 5 minutes of use).

⁷ See *infra* Section I.E.

⁸ See, e.g., INDOOR AIR QUALITY (IAQ): DOES EPA REGULATE VOLATILE ORGANIC COMPOUNDS (VOCs) IN HOUSEHOLD PRODUCTS?, ENV'T PROTECTION AGENCY, <https://www.epa.gov/indoor-air-quality-iaq/does-epa-regulate-volatile-organic-compounds-vocs-household-products> (last visited Mar. 9, 2022) (“While we do regulate VOCs in outdoor air, from an indoor air perspective, EPA has no authority to regulate household products (or any other aspect of indoor air quality).”)

⁹ 15 U.S.C. § 2051.

¹⁰ We do not address the indirect, climate-related health harms either of the methane that leaks from gas stoves or of the carbon dioxide that results from gas combustion. See Lebel et al., *supra* note 6, at 2529 (estimating that U.S. gas stoves emit 28.1 Gg of methane per year, or the equivalent of the annual carbon dioxide emissions of half a million cars). Nor do we discuss upstream, outdoor emissions associated with either natural gas extraction and distribution or electricity production. See, e.g., David J.X. Gonzalez et al., *Upstream Oil and Gas Production and Ambient Air Pollution in California*, 806 SCI. TOTAL ENV'T 1 (2022), <https://doi.org/10.1016/j.scitotenv.2021.150298>; Maninder P.S. Thind et al., *Fine Particulate Air Pollution from Electricity Generation in the US: Health Impacts by Race, Income, and Geography*, 53 ENV'T SCI. & TECH. 14010 (2019), <https://doi.org/10.1021/acs.est.9b02527>.

I. The Dangers of Gas Stove Emissions

Gas stoves generate far more emissions than their electric counterparts, leading to indoor concentrations of air pollution that can exceed levels deemed harmful by EPA outdoors and those deemed harmful by WHO indoors or outdoors—especially when stoves are used without adequate ventilation. This indoor air pollution can cause and exacerbate respiratory conditions like asthma, along with a variety of non-respiratory health harms. People with pre-existing health conditions, children, people of color, and lower-income households are particularly vulnerable to these harms.

A. Gas stoves produce dangerous levels of indoor air pollution

Cooking with gas stoves produces dangerous levels of pollutants such as NO₂ and PM_{2.5}. These levels can exceed relevant health standards and guidelines.

1. Nitrogen dioxide

NO₂ levels are particularly high in homes with gas stoves. Global studies conducted over the past two decades have found that gas stove emissions result in average indoor NO₂ concentrations of up to 65 parts per billion (ppb) over a 24-hour period, with peak concentrations reaching 189 ppb.¹¹ These concentrations vary based on cooking behaviors, with each hour of cooking representing an additional 18 ppb of NO₂ to the 24-hour average concentration.¹² Peak concentrations from gas stoves can exceed EPA limits on permissible *outdoor* concentrations of NO₂, which specify a one-hour daily maximum of 100 ppb and an annual average of 53 ppb.¹³ EPA designates outdoor areas with one-hour levels of NO₂ between 101 and 360 ppb as “unhealthy for sensitive groups.”¹⁴

Indoor NO₂ levels from gas stoves look even worse relative to international NO₂ standards and guidelines. While EPA’s ambient air quality standards are meant to “protect the public health” with “an adequate margin of safety,”¹⁵ the agency’s annual average has not been updated since 1971,¹⁶ and both the annual average and the one-hour daily maximum are significantly less protective than Canada’s more recently established ambient standards, which specify a one-hour daily maximum of 42 ppb and an annual average of 12 ppb.¹⁷ Even stricter are the World Health Organization (WHO) recommendations released in 2021, which establish an annual NO₂ exposure limit of 5.3 ppb and a 24-hour limit of 13.3 ppb.¹⁸ In other words, daily average NO₂ concentrations in homes with gas stoves are, by some estimates, almost five times higher than WHO’s 24-hour guideline.

¹¹ ENV’T PROTECTION AGENCY, INTEGRATED SCIENCE ASSESSMENT FOR OXIDES OF NITROGEN—HEALTH CRITERIA 3-37 to -38 tbl.3-4 (2016) [hereinafter 2016 Assessment], <https://www.epa.gov/isa/integrated-science-assessment-isa-nitrogen-dioxide-health-criteria>.

¹² Laura M. Paulin et al., *24-h Nitrogen Dioxide Concentration is Associated with Cooking Behaviors and an Increase in Rescue Medication Use in Children with Asthma*, 159 ENV’T RES. 118, 118 (2017), <https://doi.org/10.1016/j.envres.2017.07.052>.

¹³ NAAQS Table, ENV’T PROTECTION AGENCY, <https://www.epa.gov/criteria-air-pollutants/naaqs-table> (last visited Mar. 9, 2022).

¹⁴ ENV’T PROTECTION AGENCY, TECHNICAL ASSISTANCE DOCUMENT FOR THE REPORTING OF DAILY AIR QUALITY – THE AIR QUALITY INDEX (AQI) tbl.4 (2018), <https://www.airnow.gov/sites/default/files/2020-05/aqi-technical-assistance-document-sept2018.pdf>.

¹⁵ 42 U.S.C. § 7409(b)(1).

¹⁶ *Nitrogen Dioxide (NO₂) Standards: Table of Historical NO₂ NAAQS*, ENV’T PROTECTION AGENCY, https://www3.epa.gov/ttn/naaqs/standards/nox/s_nox_history.html (last visited Mar. 9, 2022).

¹⁷ *Canada’s Air*, CANADIAN COUNCIL OF MINISTERS OF THE ENV’T, <https://ccme.ca/en/air-quality-report> (last visited Mar. 9, 2022).

¹⁸ WORLD HEALTH ORG., WHO GLOBAL AIR QUALITY GUIDELINES: PARTICULATE MATTER (PM2.5 AND PM10), OZONE, NITROGEN DIOXIDE, SULFUR DIOXIDE AND CARBON MONOXIDE 115, 124 (2021), <https://apps.who.int/iris/handle/10665/345329> [hereinafter WHO GLOBAL AIR QUALITY GUIDELINES]. The WHO targets are expressed in units of µg/m³ and have been converted to ppb using the formula 1 ppb of NO₂ = 1.88 µg/m³.

2. Particulate matter

PM_{2.5} concentrations in homes with gas stoves can also exceed EPA outdoor standards and WHO guidelines. Existing 24-hour standards for PM_{2.5} from EPA and WHO establish standard levels of 35 µg/m³ and 15 µg/m³, respectively.¹⁹ While PM_{2.5} emissions from gas stoves depends on a variety of factors such as type of cooking (i.e., frying vs. simmering), temperature, food surface area to mass ratio, and tidiness of cooking appliance, studies have found that emission rates can climb as high as 3880 µg/m³ during oven cleaning.²⁰ The open flame design of gas stoves also means that they produce PM_{2.5} even when there is no food on the stove.²¹ One study that modeled PM_{2.5} emissions in new dwellings compliant with California’s building code and efficiency standards predicted a PM_{2.5} 24-hour exposure level of 37 µg/m³ when no range hood is used—exceeding both EPA and WHO standards.²² Smaller homes or those with poor natural ventilation would likely present even higher levels. Furthermore, concentrations below EPA’s and WHO’s standards can still pose a health risk as there is no known risk-free level of PM_{2.5} exposure.²³

B. Homes with gas stoves contain far higher levels of pollution than those with electric stoves

Compared to homes with electric stoves, homes with gas stoves contain higher levels of NO₂ and PM_{2.5}. Electric stoves do not emit NO₂, and levels of that pollutant in homes with electric stoves typically reflect background levels of NO₂ from outdoors or other sources.²⁴ By contrast, NO₂ is present in homes with gas stoves at concentrations that are 50% to over 400% higher than those in homes with electric stoves.²⁵ In addition, gas stoves produce twice as much PM_{2.5} as electric stoves and their flames emit PM_{2.5} even when there is no food on the stove, leading to higher concentrations of fine particles in the home.²⁶

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- ¹⁹ NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS) FOR PM, ENV’T PROTECTION AGENCY, <https://www.epa.gov/pm-pollution/national-ambient-air-quality-standards-naaqs-pm> (last visited Mar. 15, 2021); WHO GLOBAL AIR QUALITY GUIDELINES, *supra* note 18, at 88.
- ²⁰ TIANCHAO HU ET AL., COMPILATION OF PUBLISHED PM_{2.5} EMISSION RATES FOR COOKING, CANDLES AND INCENSE FOR USE IN MODELING OF EXPOSURES IN RESIDENCES, LAWRENCE BERKELEY NATIONAL LABORATORY 11–13 (2012), <https://doi.org/10.2172/1172959>; Roy Fortmann, INDOOR AIR QUALITY: RESIDENTIAL COOKING EXPOSURES, CAL. AIR RES. Bd. 130–32 (2001), https://ww3.arb.ca.gov/research/single-project.php?row_id=60171.
- ²¹ Hu, *supra* note 20, at 11 (observing that “indoor combustion, i.e. gas stove flames, is an important source[] of particulate matter in the absence of cooking emissions”).
- ²² WANYU CHAN ET AL., LAWRENCE BERKELEY NAT’L LAB’Y, SIMULATIONS OF SHORT-TERM EXPOSURE TO NO₂ AND PM_{2.5} TO INFORM CAPTURE EFFICIENCY STANDARDS 18 (2020), <https://escholarship.org/content/qt6tj6k06j/qt6tj6k06j.pdf>.
- ²³ Pablo Orellano et al., *Short-Term Exposure to Particulate Matter (PM₁₀ And PM_{2.5}), Nitrogen Dioxide (NO₂), And Ozone (O₃) and All-Cause and Cause-Specific Mortality: Systematic Review and Meta-Analysis*, 142 ENV. INT’L 1, 12 (2020), <https://doi.org/10.1016/j.envint.2020.105876>.
- ²⁴ See Fortmann, *supra* note 20, at 157, 159; see also Audrius Dėdelė & Auksė Miškinytė, *Seasonal Variation of Indoor and Outdoor Air Quality of Nitrogen Dioxide in Homes with Gas and Electric Stoves*, 23 ENV’T SCI. & POLLUTION RES. 17784, 17789 (2016), <https://link.springer.com/article/10.1007/s11356-016-6978-5>.
- ²⁵ ENV’T PROTECTION AGENCY, INTEGRATED SCIENCE ASSESSMENT FOR OXIDES OF NITROGEN—HEALTH CRITERIA 2-38 (2008) [hereinafter 2008 ASSESSMENT], <https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=194645>.
- ²⁶ Hu, *supra* note 20, at 11; see Qunfang Zhang et al., *Measurement of Ultrafine Particles and Other Air Pollutants Emitted by Cooking Activities*, 7 INT. J. ENVIRON. RES. PUBLIC HEALTH 1744, 1750 (2010), <https://www.mdpi.com/1660-4601/7/4/1744>.

C. Gas stove emissions are particularly dangerous in the absence of ventilation

Gas stoves that are used without range hoods are particularly likely to cause dangerous concentrations of indoor air pollution.²⁷ A 2014 study found that 12 million Californians could be exposed to concentrations of NO₂ that exceed national and state air quality standards, “simply by cooking on gas stoves without the range hood.”²⁸ The considerable danger posed by gas stove pollution prompted the California Energy Commission to propose more stringent ventilation requirements for gas stoves than for electric stoves.²⁹ While modeling predicts that using range hoods with adequate capture efficiency could reduce concentrations of pollutants such as NO₂ and PM_{2.5} below existing health standards,³⁰ many states have no ventilation requirements, many homes use “ductless” hoods that do not remove pollutants such as NO₂, and many households that have range hoods do not consistently use them because of noise or lack of habit.³¹

D. The pollutants emitted by gas stoves cause and exacerbate asthma and are linked to a variety of other health harms

NO₂ and PM_{2.5} exposure at the levels emitted by gas stoves has been linked to serious adverse health effects. In a 2016 report on nitrogen oxides, EPA identified a causal relationship between short-term exposure to NO₂ concentrations within the range generated by gas stoves and adverse respiratory effects, including asthma exacerbation.³² It also found a likely causal relationship between long-term exposure to NO₂ and the development of asthma.³³ EPA further concluded that reported increases in hospitalizations for respiratory symptoms may be attributed to NO₂ exposure.³⁴ The agency also cited research suggesting a causal link between short- and long-term exposure to NO₂ and a variety of other health harms, such as heart rate variability, systemic inflammation of other organs, adverse birth outcomes, cancer, and death.³⁵

PM_{2.5} is also widely recognized to pose serious health risks, such as premature death in people with heart or lung disease, nonfatal heart attacks, irregular heartbeat, aggravated asthma, decreased lung function, and increased respiratory symptoms such as irritation of the airways, coughing or difficulty breathing.³⁶ Causal relationships between adverse health

²⁷ Jennifer M Logue et al., *Pollutant Exposures from Natural Gas Cooking Burners: A Simulation-Based Assessment for Southern California*, 122 ENV'T HEALTH PERSPECTIVES 43, 43 (2014), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3888569/>.

²⁸ *Take Care in the Kitchen: Avoiding Cooking-Related Pollutants*, 122 ENV'T HEALTH PERSPECTIVES A155 (2014), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4050506/pdf/ehp.122-A154.pdf>.

²⁹ CAL. ENERGY COMM'N, EXPRESS TERMS FOR THE PROPOSED REVISIONS TO 2022 TITLE 24, PART 1 AND PART 6 tbl.150.0-G (2021) (finalizing higher air flow/capture efficiency ratings for range hoods over natural gas ranges to take effect in January 2023), <https://perma.cc/STU2-4FEL>.

³⁰ Chan, *supra* note 22, at 22.

³¹ BRADY ANNE SEALS & ANDEE KRASNER, RMI, HEALTH EFFECTS FROM GAS STOVE POLLUTION 16 (2020), <https://rmi.org/insight/gas-stoves-pollution-health>; Kathleen Parrott, JoAnn Emmel & Julia Beamish, *Use of Kitchen Ventilation: Impact on Indoor Air Quality*, 8 F. FOR FAM. & CONSUMER ISSUES 1, 9 (2003), <https://www.theforumjournal.org/2003/01/04/use-of-kitchen-ventilation-impact-on-indoor-air-quality/>.

³² 2016 ASSESSMENT, *supra* note 11, at 1-16 to -17.

³³ *Id.*

³⁴ *Id.* at 1-18.

³⁵ *Id.* at lxxxii tbl.ES-1, 1-17 fig.1-2. See generally HEALTH CANADA, HUMAN HEALTH RISK ASSESSMENT FOR AMBIENT NITROGEN DIOXIDE (2016), <https://perma.cc/G2CN-D4F2>.

³⁶ HEALTH AND ENVIRONMENTAL EFFECTS OF PARTICULATE MATTER (PM), ENV'T. PROTECTION AGENCY, <https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm> (last visited Mar. 9, 2022).

effects and PM_{2.5} have been found at long-term exposure levels well below EPA's ambient limits for outdoor air, which indoor concentrations caused by gas stoves likely exceed.³⁷

E. People with respiratory conditions, children, people of color, and lower-income households are especially vulnerable to gas stove pollution

While exposure to gas stove emissions creates health risks for all consumers, certain populations are especially vulnerable to these adverse effects. Most obviously, people with pre-existing respiratory conditions are at a higher risk of death and health complications from the respiratory effects of NO₂ and PM_{2.5}.³⁸

Children are also especially vulnerable. Due to their higher breathing rates, greater levels of physical activity, higher lung surface to body weight ratios, smaller bodies, and immature respiratory and immune systems, children experience greater risk of illness associated with air pollution.³⁹ These risks include increased incidence of wheeze, increased severity of asthma symptoms, and adverse effects on brain development.⁴⁰

Researchers from the Yale University School of Public Health found that, controlling for seasonal variability and allergen exposure, each 5 ppb increase in NO₂ exposure above a threshold of 6 ppb corresponds with increased severity of asthma in children aged 5–10.⁴¹ Considering that homes with gas stoves have average concentrations of NO₂ up to 27 ppb greater than homes with electric stoves,⁴² gas stove use significantly increases the risk of childhood asthma. In fact, children in homes with gas stoves are have a 24% increased risk of being diagnosed with asthma by a doctor (lifetime asthma) and have a 42% increased risk of experiencing asthma symptoms (current asthma) compared to children living in homes with electric stoves.⁴³ They are also more likely to experience wheeze, shortness of breath, and chest tightness.⁴⁴ In 2017, the Massachusetts Department of Public Health recognized gas stoves as the most commonly found asthma trigger in households with asthmatic children.⁴⁵

Furthermore, the effects of NO₂ exposure on children extend far beyond respiratory illness. A 2018 study found a link between combustion-related air pollution, such as NO₂ emitted by gas stoves, and adverse neurodevelopmental effects in

³⁷ Jie Chen & Gerard Hoek, *Long-term Exposure to PM and All-cause and Cause-specific Mortality: A Systematic Review and Meta-Analysis*, 143 ENV'T INT'L 1, 19 (2020), <https://doi.org/10.1016/j.envint.2020.105974>.

³⁸ See, e.g., *Health and Environmental Effects of Particulate Matter (PM)*, ENV'T PROTECTION AGENCY, <https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm> (last visited Mar. 9, 2022) (listing premature death as a health effect of PM_{2.5} for individuals with lung disease).

³⁹ SEALS & KRASNER, *supra* note 31, at 12–13.

⁴⁰ *Id.*

⁴¹ Kathleen Belanger et al., *Household Levels of Nitrogen Dioxide and Pediatric Asthma Severity*, 24 EPIDEMIOLOGY 320 (2013), <https://perma.cc/75TQ-KWAN>.

⁴² 2008 ASSESSMENT, *supra* note 25, at 2-39 (noting a study finding average 24-hr concentrations of NO₂ between 30–33 ppb for gas stoves with pilot lights and 6–11 ppb for electric stoves).

⁴³ Weiwei Lin et al., *Meta-Analysis of the Effects of Indoor Nitrogen Dioxide and Gas Cooking on Asthma and Wheeze in Children*, 42 INT'L J. EPIDEMIOLOGY 1724, 1728 (2013), <https://doi.org/10.1093/ije/dyt150>.

⁴⁴ Kathleen Belanger et al., *Association of Indoor Nitrogen Dioxide Exposure with Respiratory Symptoms in Children with Asthma*, 173 AM. J. RESPIRATORY & CRITICAL CARE MED. 297, 297 (2006), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2662932/>.

⁴⁵ JING GUO, *ASTHMA AMONG CHILDREN IN MASSACHUSETTS* 13 (2017), <https://www.mass.gov/doc/pediatric-asthma-data-bulletin-0/download>.

children.⁴⁶ These potential outcomes include anxiety, depression, ADHD, and memory loss, among other developmental disorders.⁴⁷

Asthma rates are notoriously high among Black children, who experience the disease at more than double the rate of white children.⁴⁸ Black and Latino families are also more likely to live in counties with high rates of outdoor air pollution across income groups,⁴⁹ which can lead to cumulative effects from combined exposure to indoor and outdoor sources of pollution. The Yale study discussed above found that the homes of children of color had the highest concentrations of NO₂, and these children experienced the most severe asthma symptoms.⁵⁰

Furthermore, the Yale study showed a strong relationship between the severity of a child's asthma symptoms and the child's socioeconomic status. Children with mothers who reported the fewest years of education and who used less medication—both factors associated with lower income—suffered more severe asthma symptoms.⁵¹ Lower-income households generally bear an increased risk of illness from air pollution because they are more likely to reside in areas with greater concentrations of outdoor air pollutants and more likely to live in smaller homes with less capacity for air circulation and ventilation.⁵² They may also be more likely to use gas stoves and ovens as an alternative source of heat, resulting in even greater concentrations of NO₂ in these homes.⁵³ Using gas stoves for heat is a known asthma risk factor for children comparable to having a smoker in the home.⁵⁴ As a result of such disparities, low-income households face higher rates and severity of asthma and increased risk of premature death from the effects of air pollution.⁵⁵ For these households, existing vulnerabilities further exacerbate the adverse health impacts of gas stove emissions.

In sum, cooking with a gas stove, especially without adequate ventilation, can lead to indoor air pollution levels that exceed relevant health guidelines and are far higher than those generated by electric stoves. These pollution levels pose significant health risks for stove users and their families—risks that are borne disproportionately by those with pre-existing respiratory conditions, children, people of color, and lower-income households.

⁴⁶ Devon C. Payne-Sturges et al., *Healthy Air, Healthy Brains: Advancing Air Pollution Policy to Protect Children's Health*, 109 AM. J. PUB. HEALTH 550, 550 (2019), <https://ajph.aphapublications.org/doi/10.2105/AJPH.2018.304902>.

⁴⁷ *Id.*

⁴⁸ MOST RECENT NATIONAL ASTHMA DATA, CDC, https://www.cdc.gov/asthma/most_recent_national_asthma_data.htm (last visited Mar. 9, 2022).

⁴⁹ DISPARITIES IN THE IMPACT OF AIR POLLUTION, AM. LUNG ASS'N, <https://www.lung.org/clean-air/outdoors/who-is-at-risk/disparities> (last visited Mar. 9, 2022).

⁵⁰ Belanger et al., *supra* note 41, at 327–28.

⁵¹ *Id.*

⁵² See SEALS & KRASNER, *supra* note 31, at 14–15; Gary Adamkiewicz et al., *Moving Environmental Justice Indoors: Understanding Structural Influences on Residential Exposure Patterns in Low-Income Communities*, 101 AM. J. PUB. HEALTH S238, S240, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3222513/pdf/S238.pdf>. Research shows that unvented gas stoves are especially common in inner-city households, where many lower-income communities of color live.

⁵³ SEALS & KRASNER, *supra* note 31, at 15.

⁵⁴ See Bruce P. Lanphear et al., *Residential Exposures Associated with Asthma in U.S. Children*, 107 PEDIATRICS 505, 505 (2001), <https://publications.aap.org/pediatrics/article-abstract/107/3/505/65985/Residential-Exposures-Associated-With-Asthma-in-US?redirectedFrom=fulltext>.

⁵⁵ See DISPARITIES IN THE IMPACT OF AIR POLLUTION, *supra* note 49.

II. Regulating Gas Stoves Through the CPSC

At present, no federal agency regulates indoor air quality in residential buildings. While EPA limits levels of NO₂ outdoors, it disclaims authority to do so indoors.⁵⁶ And while OSHA has established standards relevant to ventilation and indoor air quality, they apply only to commercial and industrial buildings.⁵⁷ Another federal agency, however, already has authority to address the threat of indoor air pollution from gas stoves in residential buildings: the CPSC, which is tasked with reducing the risk of injuries and deaths from consumer products.⁵⁸ The CPSC demonstrated concern for health harms associated with gas stoves as far back as 1985, but has not yet acted to mitigate their dangers.⁵⁹ It could do so now.

CPSC action can contribute to reducing the harm from gas stoves through two primary mechanisms. First, performance standards for new gas stoves and range hoods that focus on limiting concentrations of harmful pollutants can make gas stoves safer for households that use them. The CPSC can facilitate the development of such standards by engaging in voluntary standard-setting processes and/or by issuing mandatory standards.

Second, the CPSC can help increase consumer awareness of the dangers of gas stoves so that consumers can make better decisions about their use, including whether to purchase an induction or electric model instead, whether to install a range hood, what type of range hood to install, and how often to use that hood while cooking. The Commission can increase awareness by requiring warning labels on gas stoves, producing educational materials regarding the health effects of stove emissions and the importance of ventilation, and otherwise engaging with the public on this topic.

This section discusses these actions in more depth and explains why they are consistent with the Commission's statutory authority.

A. The CPSC should facilitate or issue performance standards for gas stoves and range hoods

To best protect consumers from gas stove-related indoor air pollution, the CPSC should either promulgate a mandatory performance standard or press the industry to adopt a voluntary standard for new gas stoves that will adequately reduce the risk of harm from their emissions. In addition to regulating stoves themselves, the CPSC should issue a mandatory performance standard or press the industry to adopt a voluntary standard for range hoods that focuses on capture efficiency and automatization. The Commission should not rely on voluntary processes if doing so unreasonably delays the creation of standards or results in standards that do not adequately address the relevant risks.

⁵⁶ See *supra* note 8.

⁵⁷ See generally OCCUPATIONAL SAFETY & HEALTH ADMIN., No. 3430, INDOOR AIR QUALITY IN COMMERCIAL AND INSTITUTIONAL BUILDINGS (2011), <https://www.osha.gov/sites/default/files/publications/3430indoor-air-quality-sm.pdf>.

⁵⁸ 15 U.S.C. § 2051; *Who We Are - What We Do for You*, CPSC, <https://www.cpsc.gov/Safety-Education/Safety-Guides/General-Information/Who-We-Are---What-We-Do-for-You> (last visited Mar. 9, 2022).

⁵⁹ ENV'T PROTECTION AGENCY, REPORT OF THE CLEAN AIR SCIENTIFIC ADVISORY COMMITTEE: A REVIEW OF THE CONSUMER PRODUCT SAFETY COMMISSION'S HEALTH EFFECTS AND EXPOSURE ASSESSMENT DOCUMENTS ON NITROGEN DIOXIDE 10 (May 1986) [hereinafter CASAC REPORT].

1. *The CPSC has statutory authority to issue mandatory standards for gas stoves and range hoods*

Product safety regulation occurs through both voluntary and mandatory standards. Voluntary standards are consensus-based and developed by private organizations.⁶⁰ They are also truly voluntary, that is, they “do not have the force of law,” and the CPSC lacks authority to bring enforcement actions based on them.⁶¹ By contrast, mandatory standards are promulgated through notice-and-comment rulemaking and are enforced by the Commission, which can impose substantial fines for violations.⁶²

The Consumer Product Safety Act’s (CPSA) statutory framework directs the CPSC to “rely” on existing voluntary standards—i.e., refrain from issuing mandatory standards—“whenever compliance with such voluntary standards would eliminate or adequately reduce the risk of injury addressed and it is likely that there will be substantial compliance with such voluntary standards.”⁶³ Thus, the CPSC may issue a mandatory standard only if there is no existing voluntary standard or if the Commission finds either that the applicable voluntary standard is “not likely to result in the elimination or adequate reduction of such risk of injury” or that “it is unlikely that there will be substantial compliance with such voluntary consumer product safety standard.”⁶⁴ The Commission must also make this determination if it proposes a mandatory standard and industry representatives submit a finalized voluntary standard in response.⁶⁵

To issue a mandatory standard, the CPSC must also find that the standard is “reasonably necessary to prevent or reduce an unreasonable risk of injury associated with such product.”⁶⁶ The text of the CPSA does not define “reasonably necessary,” but legislative history suggests that Congress “intended the Commission and the courts to work a definition on a case-by-case basis.”⁶⁷ Courts interpreting the language of the CPSA have generally required the CPSC to consider the severity of injury, likelihood of injury, and burden of regulation on manufacturers and consumers.⁶⁸ In the past, the CPSC has used this authority to regulate chronic risks from lead in children’s toys⁶⁹ and art materials.⁷⁰ The Commission has also set standards related to product emissions, such as those linked to CO poisoning from portable generators.⁷¹

⁶⁰ CPSC, STRATEGIC PLAN 2018-2022 50 (2018), https://www.cpsc.gov/s3fs-public/CPSC_2018-2022_Strategic_Plan.pdf.

⁶¹ U.S. GOV’T ACCOUNTABILITY OFF., GAO-12-582, CONSUMER PRODUCT SAFETY COMMISSION: A MORE ACTIVE ROLE IN VOLUNTARY STANDARDS DEVELOPMENT SHOULD BE CONSIDERED 11 (2012) [hereinafter GAO 2012 Report], <https://perma.cc/69WY-A9LT>; See 15 U.S.C. §§ 2068–73 (imposing penalties only for mandatory standards).

⁶² It is unlawful to “sell, offer for sale, manufacture for sale, distribute in commerce, or import” products not in compliance with mandatory standards, and any person who knowingly violates this requirement is subject to a sizable civil penalty of up to \$100,000 per violation or a maximum of \$15,000,000 for any related series of violations. 15 U.S.C. §§ 2068(a)(1); 2069. Violators may also be subject to criminal penalties, injunctive enforcement and seizure, private suits for damages, and private suits for injunctive relief. *Id.* § 2070–73.

⁶³ 15 U.S.C. § 2056(b)(1).

⁶⁴ *Id.* § 2058(f)(3)(D) (emphasis added).

⁶⁵ *Id.* § 2058(b)(2). Before the Commission chooses to rely on a finalized voluntary standard submitted in response to a proposed rulemaking, it must give interested persons the opportunity to comment on such a standard. *Id.*

⁶⁶ 15 U.S.C. § 2056(a).

⁶⁷ *Aqua Slide ‘N’ Dive Corp. v. Consumer Prod. Safety Com.*, 569 F.2d 831, 839 (5th Cir. 1978).

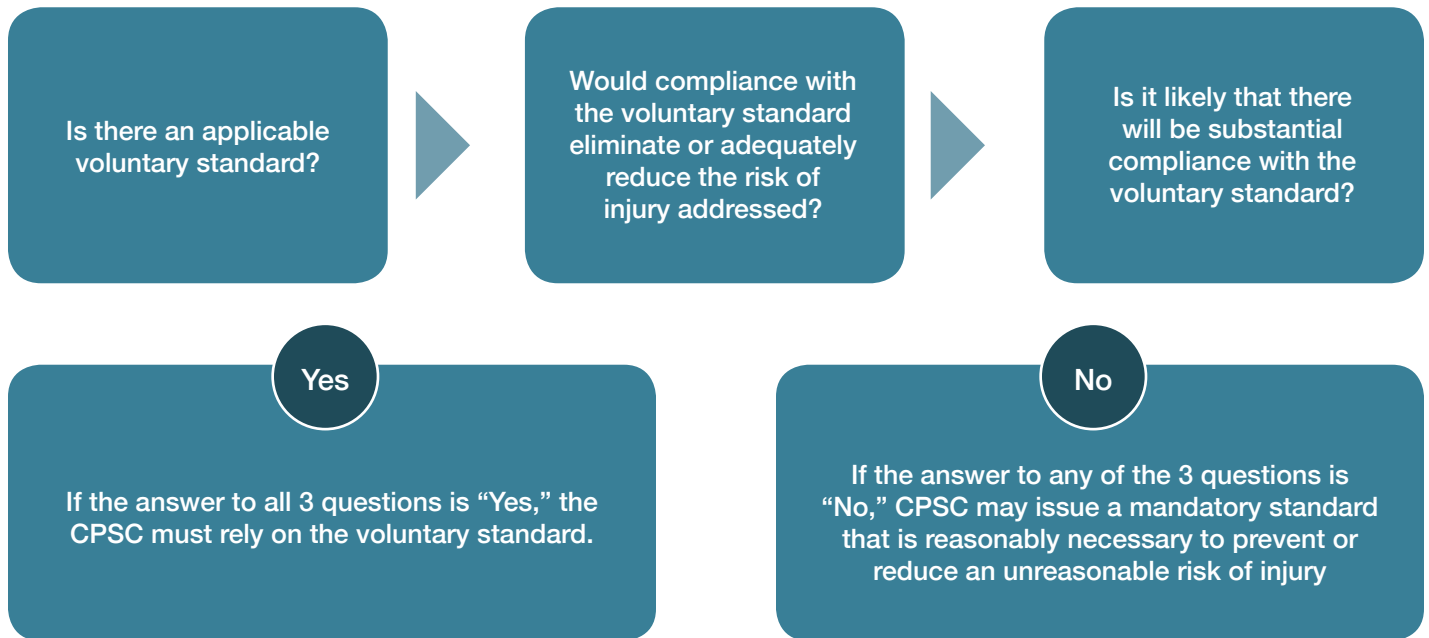
⁶⁸ See, e.g., *id.* (“[N]ecessity for the standard depends upon the nature of the risk, and the reasonableness of the risk is a function of the burden a standard would impose on a user of the product.”); *Southland Mower Co. v. Consumer Prod. Safety Comm’n*, 619 F.2d 499, 508–09 (5th Cir. 1980) (quoting *Aqua Slide*, 569 F.2d at 839); *ASG Indus., Inc. v. Consumer Prod. Safety Comm’n*, 593 F.2d 1323, 1334 (1979) (requiring consideration of the “need of the public” in deciding whether a safety standard is “reasonably necessary”); *O’Keeffe’s, Inc. v. Consumer Prod. Safety Comm’n*, 92 F.3d 940, 942 (9th Cir. 1996) (requiring the CPSC to determine that the standard is reasonably necessary to “eliminate or reduce an unreasonable risk of injury associated with the product; that the expected benefits of the amendment bear a reasonable relationship to its costs; and that the amendment imposes the ‘least burdensome’ requirement that prevents or adequately reduces the risk of injury under consideration” (quoting 15 U.S.C. 2059(f)(3), now codified in 15 U.S.C. 2058(f)(3)(F))). This reading is supported by the House Committee Report which notes that “no standard would be expected to impose added costs or inconvenience to the consumer unless there is reasonable assurance that the frequency or severity of injuries or illnesses will be reduced.” H.R. Rep. No. 1153.

⁶⁹ 16 C.F.R. § 1303.

⁷⁰ *Id.* § 1500.

⁷¹ *Id.* § 1407.3.

Figure 1.



There are currently no voluntary standards for gas stove emissions other than those related to CO poisoning.⁷² The CPSC could therefore issue a mandatory performance standard if it found doing so was reasonably necessary to make gas stoves safe. Given the dangers outlined in Section I, *supra*, the Commission could reasonably find that exposure to pollution from gas stoves poses severe risks to human health, that the likelihood of adverse effects from this pollution is unacceptably high, and that the burden of regulation on manufacturers and consumers would be justified in light of these risks. These determinations would support a decision by the CPSC to engage in rulemaking.

The CPSC could also issue a mandatory standard for range hoods. Range hoods are subject to voluntary standards, but these do not set minimum levels of capture efficiency or require the hoods to turn on automatically whenever the stove is in use.⁷³ Accordingly, they are insufficient to adequately eliminate or reduce the risk of injury from gas stove pollution and the CPSC need not rely on them. For similar reasons, the CPSC could determine that rulemaking directed at range hoods is reasonably necessary to protect consumers from gas stove pollution.

2. *If the CPSC chooses to participate in the development of voluntary standards rather than issuing mandatory standards, it should demand swift and sufficiently protective action*

The CPSC may choose to participate in voluntary standard setting processes rather than issue mandatory standards. If it does so, it should bring its weight to bear on the development process to achieve sufficiently strict gas stove and range hood standards. The Commission should also be ready to initiate rulemaking if voluntary processes stall or yield inadequate results.

⁷² See TECHNICAL SAFETY BC, GUIDELINES FOR THE GAS SERVICE INDUSTRY: CARBON MONOXIDE 33 (2018) (citing CSA/ANSI Z21.1-2018/CSA 1.1-2018: *Household Cooking Gas Appliances*, ANSI WEBSTORE <https://webstore.ansi.org/Standards/CSA/CSAANSIZ212018> (last visited Dec. 22, 2021) (limiting CO in flue gas from gas stoves to 800 ppm)), <https://www.technicalafetybc.ca/sites/default/files/2018-08/Guidelines%20for%20the%20Gas%20Service%20Industry%20-%20Carbon%20Monoxide.pdf>.

⁷³ See discussion *infra* Section II.A.3.

Historically, the CPSC has supported the development of voluntary rather than mandatory standards to address a variety of consumer product hazards. It has done so by participating in voluntary standards setting processes in a number of ways. For example, CPSC staff provides technical support, expert advice, and information to private standard-setting organizations based on the Commission's data on cause of death, injury, or incidents associated with consumer products.⁷⁴ In some cases, CPSC "[s]taff may also conduct [] research, perform laboratory tests, and provide draft language for a voluntary standard."⁷⁵ In addition, in response to a 2012 Government Accountability Office (GAO) Report⁷⁶ calling for more CPSC involvement in voluntary standards development, the CPSC issued a rulemaking in 2016 allowing "employees to participate as voting members and to accept leadership positions in voluntary standard development groups, subject to prior approval by CPSC's Office of the Executive Director."⁷⁷

This emphasis on voluntary standards over mandatory ones is even clearer in CPSC's recent activities. During fiscal year 2020, CPSC staff was actively involved in voluntary standard setting activities for 78 different products or product areas.⁷⁸ This included approval of a CPSC staff leadership role on a new committee for "ANSI CSA Z21, Gas Ranges," which will consider the issue of gas stove emissions.⁷⁹ By comparison, the Commission proposed 9 rules and finalized 15 regulatory actions (4 of which were corrections) over the same period.⁸⁰ All of the finalized rules and 6 of the 9 proposed rules were issued pursuant to a statutory mandate rather than at the Commission's discretion.⁸¹

CPSC's emphasis on voluntary standards is due to both statutory and policy reasons. As discussed above, the CPSA requires the CPSC to rely on voluntary standards when they are "adequate" and enjoy "substantial compliance."⁸² In addition, industry participants argue that the process for developing voluntary standards is faster than the CPSC's process to issue mandatory regulations, that voluntary standards are easier to change and therefore more responsive to industry innovation, and that the collaborative process for developing voluntary standards results in more buy-in and greater compliance from industry actors.⁸³

However, voluntary standards have important limitations that make them an imperfect substitute for mandatory standards. For example, manufacturers may freely choose whether to comply with voluntary standards, which makes compliance rates difficult to estimate.⁸⁴ Industry participants estimate that compliance with voluntary standards is generally

⁷⁴ Commission Participation and Commission Employee Involvement in Voluntary Standards Activities, 81 Fed. Reg. 5369, 5370 (Feb. 2, 2016).

⁷⁵ *Id.*

⁷⁶ See GAO 2012 Report, *supra* note 61.

⁷⁷ 81 Fed. Reg. at 5369.

⁷⁸ U.S. CONSUMER PRODUCTS SAFETY COMM'N, VOLUNTARY STANDARDS TRACKING ACTIVITY REPORT: FY 2020 ANN. REP. 2 (2020), https://www.cpsc.gov/s3fs-public/FY20-Annual-VSTAR-Report-FINAL_0.pdf. The CPSC's Fiscal Year runs from October 1st to September 30th. *Id.* at 2.

⁷⁹ *Id.* at 5. The purpose of the committee is to "work with CSA to revise the voluntary standard to strengthen its safety provisions and to ensure that the voluntary standard addresses hazards associated with gas ranges." *Gas Ranges*, CPSC, <https://www.cpsc.gov/Regulations-Laws-Standards/Voluntary-Standards/Ranges> (last visited Mar. 10, 2022). The authors of this report participated in two initial meetings regarding the formation of the committee.

⁸⁰ CPSC Regulations for Fiscal Year 2020, Regulations.gov, <https://www.regulations.gov/> (follow hyperlink; then search for "CPSC;" select "Consumer Product Safety Commission" under the Agency Field; select "10/01/2019" to "09/30/2020" under the Custom Dates option in the Posted field; select "Rule" and "Proposed Rule" under the Document Type field).

⁸¹ *Id.* 14 of the finalized rules were pursuant to the CPSIA and one to the Virginia Graeme Baker Pool and Spa Safety Act.

⁸² 15 U.S.C. § 2056(b)(1).

⁸³ See GAO 2012 Report, *supra* note 61, at 7–8.

⁸⁴ The CPSC tracks compliance for a subset of voluntary standards. The CPSA requires that it "devise procedures to monitor compliance with any voluntary standards-- (A) upon which the Commission has relied . . . (B) which were developed with the participation of the Commission; or (C) whose development the Commission has monitored." 15 U.S.C. § 2056. However, there are thousands of voluntary standards and industry participants "do not track compliance." GAO 2012 Report, *supra* note 61, at 7.

“high” because of market incentives such as liability risk.⁸⁵ But actual results are mixed, with some products showing high rates of compliance and others not.⁸⁶ For example, the CPSC recently noted that compliance with voluntary standards to protect against CO poisoning from portable generators is “minimal.”⁸⁷

Voluntary standards development is also not uniformly faster than CPSC action. There is no law that establishes a time frame within which a voluntary standard should be finalized,⁸⁸ and finalization can prove difficult when an industry is resistant to change. For example, negotiations among the CPSC, consumer groups, and industry actors over the choking hazard to children from window coverings has been ongoing since 1994 with no applicable voluntary standard yet in place.⁸⁹ Similarly the CPSC proposed in 1997 that the ANSI Z21.47 central furnace subcommittee adopt requirements for automatic shutoff in gas furnaces to protect against CO poisoning.⁹⁰ CPSC conducted testing and analysis and participated in voluntary standards committees over a number of years, but 24 years later there is still no voluntary standard that addresses the particular risks identified by the Commission.⁹¹

Considering these limitations, the CPSC should move to issue mandatory standards for gas stoves and range hoods if the voluntary standards development process stalls or results in insufficiently strict standards.⁹² There is no statutory bar to such an approach; while the CPSA requires the CPSC to “rely” on voluntary standards, this requirement applies only to voluntary standards that have been finalized, not to ongoing negotiations.⁹³

3. Performance standards for gas stoves and range hoods should focus on reducing risk by increasing ventilation and/or alerting users to unsafe concentrations

Performance standards for gas stoves and range hoods should focus on preventing gas stove pollution above unsafe levels. While we do not recommend particular standard designs in this report, we do highlight a non-comprehensive set of options that the Commission could reasonably consider. These options would require that the CPSC use its research authority to determine safety levels for relevant pollutants, as discussed further in the next Section.

Short of switching to an electric appliance, ensuring adequate ventilation is currently the most effective way to accomplish this goal. Homes with poor ventilation are especially likely to experience unsafe levels of gas stove pollutants such

⁸⁵ GAO 2012 Report, *supra* note 61, at 7.

⁸⁶ *Id.*

⁸⁷ CPSC, BRIEFING PACKAGE ON ASSESSMENT OF PORTABLE GENERATOR VOLUNTARY STANDARDS’ EFFECTIVENESS IN ADDRESSING CO HAZARD, AND INFORMATION ON AVAILABILITY OF COMPLIANT PORTABLE GENERATORS 3 (2022), <https://perma.cc/4STH-D59S>.

⁸⁸ U.S. GOV’T ACCOUNTABILITY OFF., GAO-15-17, CONSUMER PRODUCT SAFETY COMMISSION: CHALLENGES AND OPTIONS FOR RESPONDING TO NEW AND EMERGING RISKS 11 (2014).

⁸⁹ *Id.* at 11–12; *see* Corded Window Coverings; Extension of Comment Period, 80 Fed. Reg. 15,173 (Mar. 23, 2015). The CPSC recently issued a notice of proposed rulemaking on corded window coverings. Safety Standard for Operating Cords on Custom Window Coverings, 87 Fed. Reg. 1014 (Jan. 7, 2022).

⁹⁰ *Gas Appliances (CO Sensors)*, CPSC, <https://www.cpsc.gov/Regulations-Laws--Standards/Voluntary-Standards/Gas-Appliances-CO-Sensors> (last visited Nov. 24, 2021).

⁹¹ *See id.*

⁹² The CPSC should reconsider how it evaluates progress in voluntary standard setting processes generally. In particular, it should establish criteria for when the voluntary standards setting process has stalled to the extent that a mandatory standard is necessary. Once it has done so, it should move quickly to establish a mandatory standard.

⁹³ *See* 15 U.S.C. 2058(b)(2) (“...the Commission shall terminate any such proceeding and rely on a voluntary standard only if such voluntary standard is in existence. For purposes of this section, a voluntary standard shall be considered to be in existence when it is finally approved by the organization or other person which developed such standard, irrespective of the effective date of the standard.”).

as NO₂.⁹⁴ However, when “properly installed, maintained, and operated,” ducted ventilation systems “can reduce NO₂ and other pollutant levels and [are] associated with better respiratory health.”⁹⁵ In fact, even as early as 1995, the EPA and CPSC identified a range hood as a way to reduce indoor air pollution from gas stoves.⁹⁶ Importantly, the benefits of ventilation are attributable to the use of *ducted* range hoods, because these models filter air to the outdoors. Recirculating or ductless range hoods, such as those typically used with over-the-range microwaves, can reduce PM_{2.5} if cleaned on a regular basis but do not generally remove harmful pollutants associated with gas stoves.⁹⁷

Accordingly, one means of reducing the risk of health harms from gas stove emissions would be to require that each new stove be sold with a ducted range hood. This would ensure that consumers have the equipment necessary to properly vent their stoves and prevent indoor air quality from deteriorating to a dangerous degree.⁹⁸ While such a standard may complicate purchases for consumers that already live in homes with an adequate range hood installed or where installation of a ducted range hood may be impractical or impossible, a consumer could avoid the obligation to purchase a range hood by opting for an electric stove instead. Otherwise, CPSC could also consider creating limited exemptions to a requirement that gas stoves and range hoods be sold together.

Additionally, or alternatively, manufacturers could equip gas stoves with sensors that visually or aurally alert users when pollution concentrations around the stove become unsafe. A person who uses a gas stove equipped with a readout for current NO₂ levels, for example, could make real-time decisions about whether to increase ventilation, turn off a burner, or otherwise alter his or her behavior to increase safety.

Performance standards for range hoods, focused on capture efficiency and automatization, would be a valuable complement to any stove-focused standards. Residential ducted range hoods are subject to voluntary standards that regulate noise and airflow.⁹⁹ However, air flow measurement alone does not account for a hood’s “capture efficiency,” or its ability to remove harmful pollutants such as NO₂ and PM_{2.5} and expel them to the outside.¹⁰⁰ In fact, researchers at the Lawrence Berkeley National Laboratory (LBNL) found that, under testing conditions, hoods operating at the minimum air flow requirement have capture efficiencies below 25% when front burners are used.¹⁰¹ Often, hoods actually installed in homes do not meet rated or advertised flow rates, meaning that capture efficiency for installed hoods may be even lower.¹⁰²

⁹⁴ Logue et al., *supra* note 27, at 43.

⁹⁵ SEALS & KRASNER, *supra* note 31, at 16.

⁹⁶ ENV’T PROTECTION AGENCY & CONSUMER PRODUCTS SAFETY COMM’N, THE INSIDE STORY: A GUIDE TO INDOOR AIR QUALITY 16 (1995) [hereinafter THE INSIDE STORY]. The report also recommended switching to pilotless ignition. *Id.* Pilot lights for gas stoves have since been banned.

⁹⁷ Yang-Seon Kim et al., *Development of A Standard Capture Efficiency Test Method for Residential Kitchen Ventilation*, 24 SCI. & TECH. BUILT ENV’T 176, 176 (2018), [https://doi.org/10.1016/j.envres.2020.110561](https://www.tandfonline.com/doi/full/10.1080/23744731.2017.1416171?casa_token=Ro3Q242uMkMAAAA%3AqAU1UIWCWLnX6BkAdNLwJt-H8czuUKVORc8KOMcVtz6vci9GBFLNNUWr57-wM7xYqggA3Uu1Jxk; MyDzung T. Chu et al., Real-Time Indoor PM_{2.5} Monitoring in an Urban Cohort: Implications for Exposure Disparities and Source Control, 193 ENV’T RES. 1, 8 (2021), <a href=).

⁹⁸ A past example of product pairing is a voluntary standard requirement for anchoring systems for heavy furniture. See ASTM F2057-14: *Standard Safety Specification for Clothing Storage Units*, ANSI WEBSTORE, <https://webstore.ansi.org/standards/astm/astmf205714> (last visited Mar. 10, 2022).

⁹⁹ See ARB Research Seminar: *Kitchen Ventilation Solutions to Indoor Air Pollution Hazards from Cooking*, CAL. AIR RES. BD., <https://www.arb.ca.gov/research/seminars/singer2/singer2.htm> (last visited Nov. 24, 2021) [hereinafter ARB RESEARCH SEMINAR]. Residential ducted range hoods are covered under ANSI/ASHRAE Standard 62.2. See *Standards 62.1 & 62.2*, ASHRAE, <https://www.ashrae.org/technical-resources/bookstore/standards-62-1-62-2> (last visited Mar. 10, 2022).

¹⁰⁰ Kim, *supra* note 97, at 176.

¹⁰¹ ARB RESEARCH SEMINAR, *supra* note 99.

¹⁰² *Id.*

To address this issue, LBNL researchers worked alongside voluntary standard setting organizations to develop a test method for measuring capture efficiency.¹⁰³ This is a significant step towards standardizing test methods and arriving at measurements that more clearly reflect a range hood's contribution to indoor air quality. However, to truly be effective, such a standard should set capture efficiency targets for relevant gas stove pollutants. For example, one simulation predicted that for the vast majority of newly built homes in California, range hoods would need to have a minimum capture efficiency of 70% and 60% to avoid unacceptably high levels of NO₂ and PM_{2.5}, respectively.¹⁰⁴ The current voluntary standard does not set such minimum capture efficiency targets or require disclosure of tested capture efficiency.¹⁰⁵

In addition, an automatic mechanism for range hoods, such as one that turns on whenever the gas stove is in use or whenever the range hood, through a sensor, detects that pollutant levels have surpassed a safe level, would ensure frequent use. Even consumers who have effective range hoods may not use them while cooking; one survey showed that only 8% of respondents used ventilation every time they cooked.¹⁰⁶ The most common reasons given for not using the range hood were noise, not thinking that ventilation was necessary, or simply not thinking about ventilation at all.¹⁰⁷ An automatic mechanism would overcome inertia associated with turning on the range hood and could promote adequate ventilation.

4. *The CPSC should use its research authority to better define performance standards*

Whether it pursues voluntary or mandatory performance standards, the CPSC should use its research authority to inform the standard-setting process by studying the circumstances under which different gas stove pollutants cause unreasonable health risks to consumers and testing feasible compliance alternatives to reduce these risks. The CPSC should immediately move to conduct such research, which will be critical both for determining whether a proposed voluntary standard adequately protects against the health risks of gas stoves and for supporting mandatory standards if the Commission chooses to promulgate them.

The CPSA gives the CPSC the power to “conduct research, studies, and investigations on the safety of consumer products and on improving the safety of such products.”¹⁰⁸ The Commission can “test consumer products and develop product safety test methods and testing devices.”¹⁰⁹ It can also offer “training in product safety investigation and test methods.”¹¹⁰ Such research and testing can be highly instrumental to guide the development of voluntary standards and inform the Commission's regulatory objectives.¹¹¹

The CPSC should use this research authority to study the health risks of exposure to levels of pollutants generated by gas stoves. The CPSC has, in fact, studied gas stove emissions in the past. As early as 1985, the CPSC was “concerned about

¹⁰³ See ASTM E3087-18: Standard Test Method for Measuring Capture Efficiency of Domestic Range Hoods, ANSI WEBSTORE, <https://webstore.ansi.org/Standards/ASTM/ASTME308718> (last visited Mar. 28, 2022).

¹⁰⁴ Chan, *supra* note 22, at 2.

¹⁰⁵ See ASTM E3087-18, *supra* note 103. The voluntary standard is based on the methodology developed by Kim et al., *supra* note 97, which does not identify minimum targets. Rather, the voluntary standard is “intended to quantify the capture efficiency of range hoods.” ASTM E3087-18, *supra* note 103.

¹⁰⁶ Parrott, *supra* note 31, at 9.

¹⁰⁷ *Id.*

¹⁰⁸ 15 U.S.C. § 2054(b)(1).

¹⁰⁹ *Id.* § 2054(b)(2).

¹¹⁰ *Id.*

¹¹¹ See *Gas Appliances (CO Sensors)*, *supra* note 90. See also 15 U.S.C. § 2058(f)(1) (requiring the Commission to make findings regarding “the degree and nature of the risk of injury the rule is designed to eliminate or reduce” when promulgating a rule).

exposure to nitrogen dioxide associated with the use of gas cooking stoves and a variety of home combustion heaters.”¹¹² In 1995, EPA and CPSC co-authored a report called, “The Inside Story: A Guide to Indoor Air Quality,” which identifies “unvented kerosene and gas space heaters, woodstoves, fireplaces, and gas stoves” as contributors to indoor “carbon monoxide, nitrogen dioxide, and particles” pollution.¹¹³ The CPSC should dust off and build on these early efforts, identifying relevant gas stove pollutants and setting safety levels where relevant that reflect the latest findings. In doing so, the CPSC should carefully consider the recent WHO air quality guidelines, EPA’s national ambient air quality standards for outdoor pollution, and findings from relevant agencies in other countries, such as Health Canada, discussed in Section I.A, *supra*.

Beyond that, the CPSC should use its research authority to study the feasibility of different compliance alternatives. To the extent they exist, the Commission should explore all available technological advances and design features that may directly reduce gas stove emissions. Concurrently, it should explore compliance methods that will reduce emission-related harm by increasing ventilation and/or alerting stove users to unsafe concentrations. For example, the CPSC should explore which range hood designs would adequately reduce harmful pollutants and test the feasibility of automatic ventilation and built-in air quality sensors.

B. The CPSC should increase consumer awareness of the harms of gas stoves

In addition to issuing mandatory performance standards or pressing for effective voluntary ones, the CPSC can reduce the risk posed by gas stoves by increasing consumer awareness of stoves’ emissions and their potential health consequences. Requiring warning labels on stoves and expanding the stove-related educational materials on the Commission’s website could help consumers make better decisions about whether and under what conditions to use the products.

1. At a minimum, the CPSC should issue a warning label for gas stoves

Apart from performance standards, the CPSC can also issue mandatory standards in the form of warning labels. The same requirements to “rely” on voluntary standards discussed in Section II.A.3, *supra*, apply to warning labels.¹¹⁴ However, because there are no voluntary standards that require warning labels on stoves regarding the health risks posed by NO₂ and other stove emissions, the CPSC is free to issue a mandatory standard.

To adequately inform consumers of the dangers of gas stove emissions, the CPSC should require, at a minimum, a warning label that indicates that gas stoves emit NO₂ and PM_{2.5}; explains the health dangers from each of these pollutants at concentrations common to gas stoves; and instructs consumers to use adequate ventilation. Such a warning label would be similar to CPSC labeling requirements for portable generators, which caution users of the dangers of CO poisoning.¹¹⁵

Requiring manufacturers to disclose the risks of gas stove emissions may lead to safer gas stove and range-hood designs. This effect has been demonstrated by past federal labeling requirements. For example, the introduction of energy-efficiency-related labeling requirements for appliances in the 1970s may have increased consumers’ responsiveness to energy prices, which in turn increased firms’ incentives to offer more energy-efficient models as energy prices rose.¹¹⁶ In

¹¹² CASAC REPORT, *supra* note 59, at 10.

¹¹³ THE INSIDE STORY, *supra* note 96, at 15.

¹¹⁴ *Id.* § 2056(a).

¹¹⁵ Portable Generators; Final Rule; Labeling Requirements, 72 Fed. Reg. 1443 (Jan. 12, 2007).

¹¹⁶ See Richard G. Newell et al., *The Induced Innovation Hypothesis and Energy-Saving Technological Change*, 114 Q.J. ECON. 941, 964 (1999), <https://www.jstor.org/stable/2586888>.

addition, front-of-packaging nutritional labeling requirements have been associated with product reformulation.¹¹⁷ To the extent that safer designs are available, a similar effect may result from gas stove warning labels.

2. *The CPSC should launch a public education campaign on the dangers of gas stoves*

The CPSC has the authority to make public disclosures of safety information to consumers.¹¹⁸ To that end, CPSC produces a variety of public-education materials, both digitally and in print.¹¹⁹ Section 12 of the Consumer Product Safety Improvement Act (CPSIA) also requires the CPSC to create a publicly available “searchable public database of reports of harm” that are “related to the use of consumer products and other products or substances within the jurisdiction of the CPSC.”¹²⁰ The database, Saferproducts.gov, allows consumers to “submit reports of harm,” which are shared with both the manufactures and private labelers identified in the report, as well as publicly on the website.¹²¹

The current materials on the CPSC website include posters on carbon monoxide poisoning generally and fire safety in the kitchen,¹²² but they do not address the health effects of gas stove emissions. An inspection of Saferproducts.gov reveals many complaints related to gas leakage from stoves.¹²³ Many of the complaints relate to, for example, the gas turning on when the knobs of the stove are merely brushed, causing gas emissions in the home, or a strong gas smell when the stove or oven is turned on.¹²⁴ However, SaferProducts.gov does not include information about the health effects of long-term low-level exposure to NO₂ or PM_{2.5}, likely because consumers are unaware of dangers from gas stove emissions.

The CPSC should improve its offering of informational materials to include the dangers of gas stove emissions, especially for children and affected communities. Such materials should be provided in easy-to-understand language and translated into multiple languages to best reach a broad pool of consumers.

Informed consumers will be better able to make purchasing and ventilation choices for themselves and their families, such as purchasing electric or induction stoves instead of gas stoves, deciding to install and use a ducted range hood, or otherwise increasing ventilation. They can also help the CPSC to identify incidents through Saferproducts.gov. Incident reports on the website do not typically arise out of long-term low-level exposure,¹²⁵ but greater consumer knowledge of such risks can lead to more reports. Such reports could broaden awareness of the issue and potentially provide the CPSC with valuable data if, for example, consumers took NO₂ measurements within their homes and reported high concentrations as a safety concern.

¹¹⁷ Daphne L.M. van der Bend et al., *The Influence of a Front-of-Pack Nutrition Label on Product Reformulation: A Ten-Year Evaluation of the Dutch Choices Programme*, 6 FOOD CHEMISTRY: X 1 (2020) <https://doi.org/10.1016/j.fochx.2020.100086>.

¹¹⁸ Public disclosure of certain information is subject to confidentiality and other restrictions, but the CPSC may initiate “public disclosure of information that reflects on the safety of a consumer product or class of consumer products” so long as it establishes “procedures designed to ensure that such information is accurate and not misleading.” 15 U.S.C. § 2055(b)(6).

¹¹⁹ See SAFETY EDUCATION, CPSC, <https://www.cpsc.gov/Safety-Education> (last visited Mar. 10, 2022).

¹²⁰ ABOUT, SAFERPRODUCTS.GOV, <https://www.saferproducts.gov/About> (last visited Mar. 10, 2022); James E. Orescanin, *Exploring Change: An Analysis of the Consumer Product Safety Commission*, 30 LOY. CONSUMER L. REV. 72, 80 (2017).

¹²¹ ABOUT, SAFERPRODUCTS.GOV, *supra* note 120.

¹²² See, e.g., *Serve Up Fire Safety in the Kitchen*, CPSC, <https://www.cpsc.gov/Safety-Education/Safety-Guides/Fire/Serve-up-Fire-Safety-in-the-Kitchen>; Safety Education Materials, CPSC, <https://www.cpsc.gov/Safety-Education/Safety-Education-Materials> (follow hyperlink; then select “Carbon Monoxide” in the Select Topic field).

¹²³ PUBLIC SEARCH, SAFERPRODUCTS.GOV, <https://www.saferproducts.gov/PublicSearch> (follow hyperlink; then search for “gas range”).

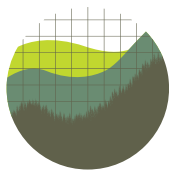
¹²⁴ *Id.*

¹²⁵ *But see* Report No. 20170520-966E4-2147400355, SAFERPRODUCTS.GOV, CPSC (May 20, 2017), <https://www.saferproducts.gov/PublicSearch> (follow hyperlink; then search for report number) (reporting that one family discovered, after a month of feeling lethargic with headaches, that their new oven had been leaking carbon monoxide due to a manufacturing defect).

Conclusion

Gas stove emissions pose a significant health risk to millions of Americans, including the approximately 25 million people who suffer from asthma in the United States.¹²⁶ This danger is not currently addressed by federal regulation. Using its existing authority under the CPSA, the CPSC can contribute to the reduction of harm from gas stoves by facilitating or issuing performance standard for gas stoves and range hoods, requiring warning labels on gas stoves, and developing public-education materials.

¹²⁶ ASTHMA FACTS AND FIGURES, ASTHMA & ALLERGY FOUND. AM., <https://www.aafa.org/asthma-facts> (last visited Mar. 9, 2022).



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