U.S. Government Accountability Office

Gas Stoves: Risks and Safety Standards Related to Products and Ventilation

GAO-25-107514
Q&A Report to Congressional Committees
March 18, 2025

Why This Matters

Millions of Americans use gas stoves—that is, gas ovens, cooktops, and ranges. While voluntary standards for gas stoves are developed and updated regularly through consensus-based processes to help protect users, researchers and others have raised concerns about the potential risks from emissions associated with these appliances. However, there is disagreement about the extent of linkage between the emissions produced by gas stoves and certain health issues.

The Senate Report accompanying the Financial Services and General Government Appropriations Bill of 2024 includes a provision for us to report on actions taken by industry and the federal government over the last 25 years to improve gas stove safety. This report describes the potential risks associated with gas stoves, relevant safety standards, efforts to improve safety, and challenges encountered in implementing these improvements.

Key Takeaways

- Gas stoves pose certain health and safety risks, due in part to potentially harmful emissions, including nitrogen dioxide, but there is ongoing debate about the extent of their impact on human health.
- Gas stove safety is addressed through voluntary industry consensus standards, third-party testing, and state and local building codes. Retailers generally require gas stoves they sell to meet the voluntary standards.
- Industry participants, researchers, and regulatory agencies are engaged in ongoing efforts to enhance safety features, testing, and ventilation systems to further mitigate potential emissions risks.
- Challenges to improving gas stove safety involve regulatory coordination, economic constraints, consumer behavior, and technological integration. Addressing these challenges requires collaboration among standards development organizations, government entities, and industry stakeholders.

What do available data show about the extent of gas stove use?

Census Bureau and sales data indicate that gas stove use has been relatively stable since at least 2015 but may be declining. According to the American Housing Survey conducted by the Census Bureau, from 2015 to 2021, 33.3 percent (+/- 0.3 percent) of households used piped gas as their cooking fuel source, indicating the use of gas stoves. However, gas stove shipments in the U.S. (domestically produced and imported) declined from 46 percent of all stove shipments in 2020 to 37 percent in 2023, according to the Association of Home Appliance Manufacturers.

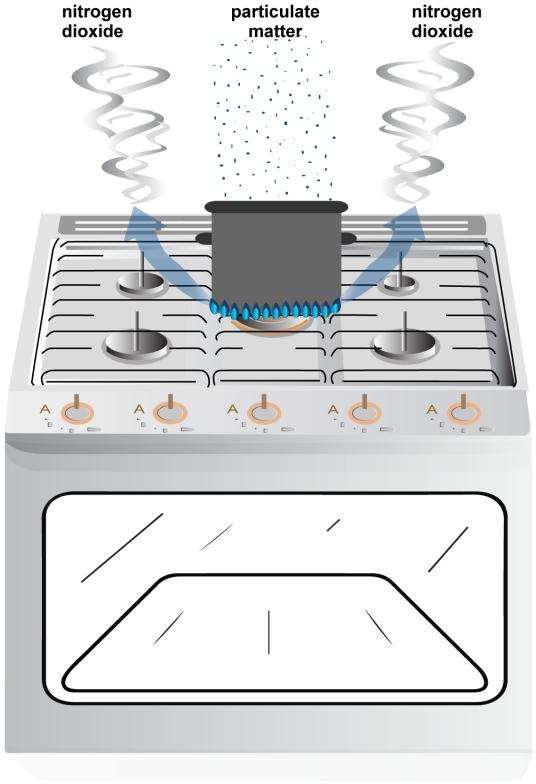
While declining shipments may suggest a decrease in future usage, other factors also influence stove type. These include the geographic location of new construction and short-term purchasing patterns, which may have varied during the COVID-19 pandemic, according to the Association of Home Appliance Manufacturers.

The decision to install a gas stove generally occurs during the construction of a residence and is subject to the availability of gas service to the building. For example, two industry associations we interviewed noted that switching stove types post-construction is uncommon due to the cost and work involved in installing a gas supply for a new gas stove or upgrading electrical service for a new 240-volt electric stove.[1]

What potential hazards have been identified related to gas stoves?

Gas stoves pose risks that include carbon monoxide and nitrogen dioxide emissions, as well as risks that are common to all stoves, including particulate matter emissions, fires, and burns.[2] When in use, gas stoves emit nitrogen dioxide, a respiratory irritant that can affect health depending on exposure levels and individual sensitivity (see fig. 1). Studies have found that nitrogen dioxide emissions from gas stoves can exceed the 1-hour exposure limits set by the Environmental Protection Agency (EPA) for outdoor air and recommended by the World Health Organization for both indoor and outdoor air.[3] In addition, gas stove cooking produces carbon monoxide, which can reach potentially lethal levels with a malfunctioning stove in a space with inadequate ventilation.

Figure 1: Gas Stove Cooking Emissions of Health Concern



Source: GAO (icons). | GAO-25-107514

Note: Gas stove cooking produces particulate matter through the combustion process as well as some cooking processes (such as pan frying). In addition to nitrogen dioxide and particulate matter, gas stove cooking emits carbon dioxide and carbon monoxide, and it can also emit methane, benzene, and other gases. In this report, we focus on nitrogen dioxide, particulate matter, and carbon monoxide because they are described by the Environmental Protection Agency as major pollutants from gas stoves. The amount of carbon monoxide produced is usually not hazardous. However, if gas stoves are not working properly or are used incorrectly, dangerous levels of carbon monoxide can result in a space with inadequate ventilation.

However, there is no consensus on the health effects of nitrogen dioxide emissions directly attributable to gas stove cooking. For example, one meta-analysis (a study analyzing the results of other studies) found a correlation between gas stove use and increased asthma risk in children but noted that the relationship was not necessarily attributable to nitrogen dioxide production alone.[4] Another meta-analysis pointed out that the prior meta-analysis may not have sufficiently accounted for confounding factors, such as socioeconomic status or family history of asthma or allergies, which may explain the association between gas stoves and asthma.[5]

In addition, both gas and electric stoves can present hazards related to fires, burns, and particulate matter. Fires can occur due to gas leaks, electrical malfunction, and accidents while cooking, such as a cloth igniting on or near the cooktop. Burns are another risk, as users may be exposed to high surface temperatures. Additionally, cooking on any stove emits fine particulate matter (airborne particles less than 2.5 micrometers in diameter) during some cooking processes, such as pan frying. In addition, gas stoves emit ultrafine particulate matter (airborne particles with a diameter of 0.1 micrometers or less) from the combustion process. Ultrafine and fine particulate matter may affect heart and lung health, depending on exposure time, concentrations, general health, and other factors.

The Consumer Product Safety Commission (CPSC) announced 35 gas stove recalls between June 1973 and February 2024, according to the agency.[6] These recalls addressed hazards related to fires, burns, explosions, and carbon monoxide exposure. In 2022 and 2023, about 60,000 stoves were recalled after it was discovered they could emit dangerous levels of carbon monoxide.

What safety standards are in place related to gas stoves?

Safety standards for gas stove products and ventilation systems have been affected by several standards development organizations. These organizations develop voluntary, consensus-based standards designed to support the safe manufacture and use of gas stoves. Parties involved in developing these standards can include building safety professionals and representatives of industry, government, and labor groups, as well as academic researchers and consumer advocates.

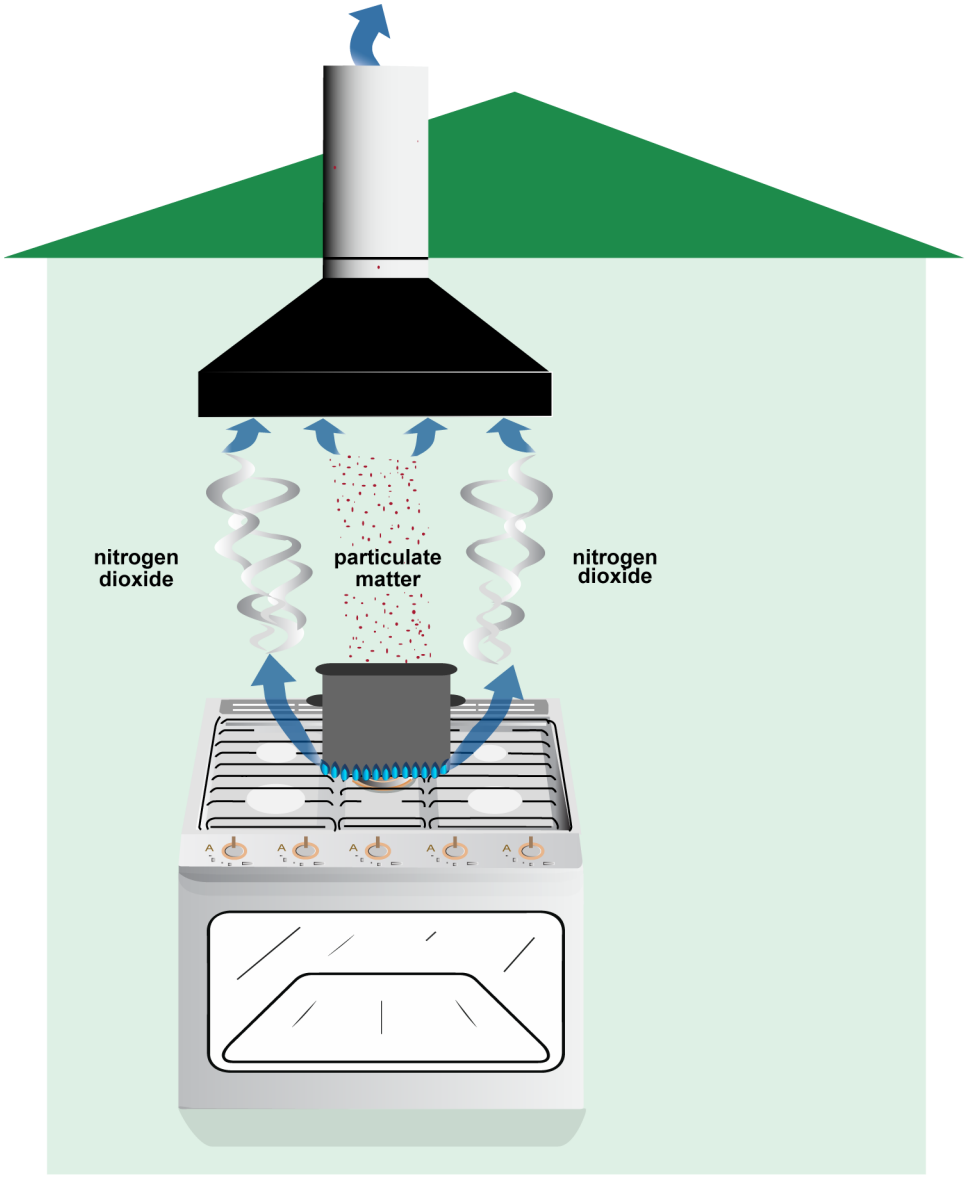
Product safety standards

The Canadian Standards Association (CSA) Group has developed consensus-based standards for gas stove safety, which have been accredited by the American National Standards Institute (ANSI).[7] These standards—known as Canadian Standards Association/American National Standards Institute (CSA/ANSI) Z21.1—address various safety features for gas stoves, including protection against accidental burns and prevention of incomplete gas combustion, which can lead to carbon monoxide exposure.

Ventilation standards

While not specific to gas stoves, ventilation standards draw from a range of organizations and experts to address indoor air quality. Potentially harmful emissions from gas stoves can be mitigated through ventilation that directs emissions to the outdoors (see fig. 2).

Figure 2: External Ventilation of Gas Stove Emissions of Health Concern



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Note: Gas stove cooking produces particulate matter through the combustion process as well as some cooking processes (such as pan frying). In addition to nitrogen dioxide and particulate matter, gas stove cooking emits carbon dioxide and carbon monoxide, and it can also emit methane, benzene, and other gases. In this report, we focus on nitrogen dioxide, particulate matter, and carbon monoxide because they are described by the Environmental Protection Agency as major pollutants from gas stoves. The amount of carbon monoxide produced is usually not hazardous. However, if gas stoves are not working properly or are used incorrectly, dangerous levels of carbon monoxide can result in a space with inadequate ventilation. Additionally, the effectiveness of ventilation systems such as range hoods varies in capturing and exhausting the emissions. As a result, some of the emissions can remain in the room or home.

The International Residential Code (IRC), which has been adopted by the vast majority of states (sometimes with modifications by states and municipalities), includes ventilation standards for residential dwellings.[8] Among others, the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) has contributed to the IRC ventilation requirements.[9] IRC and related ASHRAE standards consider both dwelling-unit ventilation and local exhaust ventilation as effective systems for removing contaminants from locations such as kitchens. For instance, ASHRAE standards consider the size and layout of the

kitchen as well as the operation and interrelationships between different exhaust systems (e.g., continuous whole-house ventilation and on-demand exhaust specific to the kitchen, including range hoods).

While kitchen ventilation systems in homes include those that exhaust emissions directly outdoors, current IRC standards also allow for the use of range hoods that recirculate air in conjunction with ventilation in the household. According to organizations and researchers with expertise in indoor air quality, ventilation system effectiveness can vary depending on factors including the size of the kitchen and home, the interaction of any kitchen ventilation with whole-house ventilation, the air flow ratings of motorized fans and blowers in the ventilation devices, and the capture efficiency of range hoods.

There are no federal standards for indoor air quality in residential dwellings. However, the Department of Housing and Urban Development (HUD) has established construction and safety standards for manufactured homes that include ventilation requirements.[10]

Who ensures the safety standards are met?

Third-party testing organizations (hired by stove manufacturers), CPSC, and others help ensure manufacturers meet product safety standards, while building inspectors help ensure builders meet ventilation standards.

Product safety

Manufacturers contract with third-party testing organizations to verify compliance with voluntary safety standards. These organizations review manufacturing processes, certify products that meet the standards, and label them as “listed.” Major retailers typically require the products they sell to be listed. State and local building codes generally require builders to install listed gas stoves.

CPSC currently relies on manufacturers voluntarily adhering to applicable product safety standards to ensure gas stove safety but has authority to create mandatory standards if it determines that there is no existing voluntary standard that will eliminate or adequately reduce a risk of injury. In making such a determination, CPSC must assess whether 1) compliance with the voluntary standards will adequately protect consumers and 2) it is likely that manufacturers will comply with the standards. CPSC also has authority to require manufacturers to recall gas stoves that the Commission has determined create a substantial product hazard as defined in the Consumer Product Safety Act.[11]

Ventilation standards

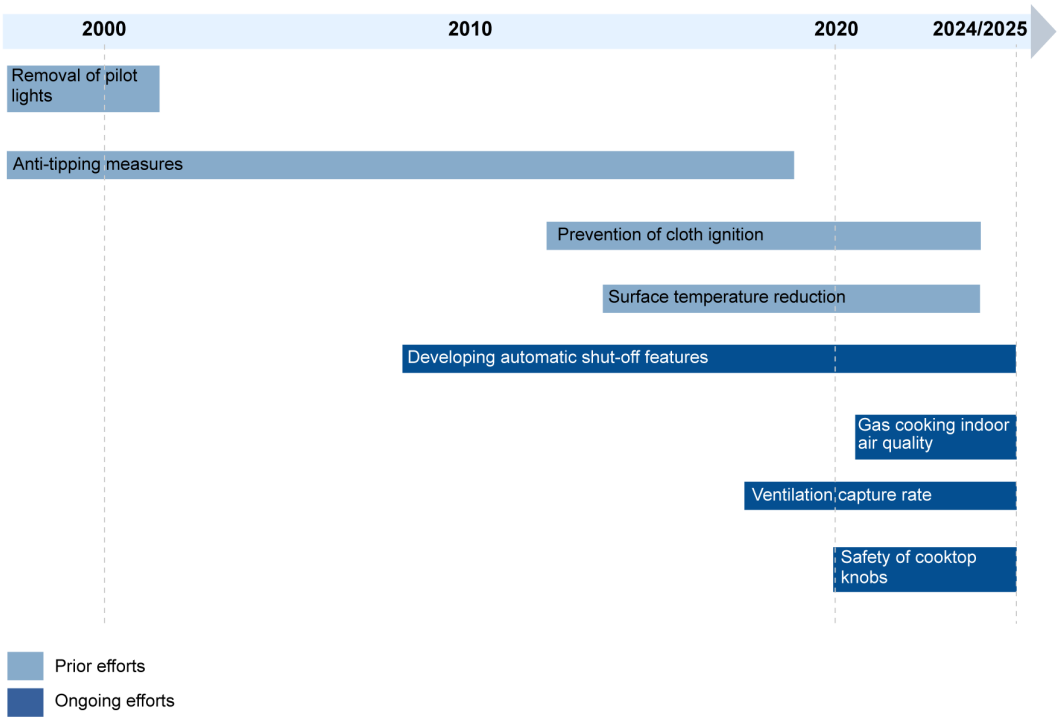
Building inspectors ensure compliance with applicable ventilation standards in residential buildings during construction or remodeling. These standards vary among states and municipalities. State and local building codes generally reference the IRC, which incorporates standards for ventilation, or supplement the IRC standards. Ventilation standards vary across the country because not all states and municipalities have adopted the same version of the IRC, which is updated every 3 years.

What actions have industry participants taken to improve gas stove safety?

Over the past 25 years, gas stove industry participants have helped develop and implement safety features and standards for gas stoves and made improvements in ventilation methods.

Safety improvements for both gas and electric stoves include reducing exterior surface temperatures to prevent burns and implementing measures to prevent stoves from tipping. Electronic controls, including remote control of the appliance, on both types of stoves has been an emerging trend. Improvements specific to gas stoves include the removal of pilot lights, the introduction of automatic shut-off features to prevent carbon monoxide emissions, and enhancements to prevent burners from being accidentally turned on (see fig. 3).

Figure 3: Key Safety Improvements Related to Gas Stoves, 2000–2025



Source: GAO summary of industry information. | GAO-25-107514

More recently, CSA Group has begun to study gas stove emissions. For example, in 2022, the Gas Range Stoves and Indoor Air Quality working group was formed to conduct further research on emissions and explore the development of testing methods for measuring emission levels, including for nitrogen dioxide.[12] These collaborative efforts involve various industry participants, CPSC, CSA Group, and other subject matter experts. As of December 2024, CSA Group was exploring funding options to continue research projects developing testing methodologies and a test facility that can be replicated.

Industry participants are also studying methods for improving ventilation, according to our interviews and review of research and documentation. For example, researchers are working to enhance test methods for measuring the "capture rate" of vent hoods to better determine how to effectively capture and exhaust emissions from gas stoves. One industry participant noted ongoing efforts to improve vent hood capture rates and reduce energy requirements and noise levels of ventilation fan motors. Industry participants said they would continue to focus on gas stove emissions and ventilation improvements.

What has the federal government done to improve gas stove safety?

Federal agencies have undertaken several efforts to enhance gas stove safety, including sponsoring research, contributing to the development of safety features, and executing product recalls.

- **CPSC:** CPSC collaborates with industry participants and subject matter experts on committees responsible for updating voluntary, consensus-based standards related to gas stoves. CPSC participates in the CSA/ANSI Z21.1 Committee, which addresses household gas cooking appliances. CSA Group, CPSC, and others are currently studying emissions from gas stoves and working to develop test methods for various emissions, including nitrogen dioxide. Previously, CPSC participated in efforts that established standards to include preventing stoves from tipping. CPSC has also engaged in product recalls involving gas stoves. According to CPSC officials, CPSC has not promulgated mandatory standards because the voluntary standards are effective and there is widespread industry compliance with the voluntary standards.
- **EPA:** EPA's Federal Interagency Committee on Indoor Air Quality brings together industry, government, and research participants to discuss indoor air quality, including issues related to gas stoves. Through this committee, EPA has promoted research and advised standards development organizations on indoor air quality considerations, including irritants such as nitrogen dioxide. EPA has also recommended the use of exhaust fans that vent outdoors.
- **Occupational Safety and Health Administration:** The agency's Nationally Recognized Testing Laboratory Program recognizes laboratories that meet the qualifications to perform testing and certification for conformance with product safety test standards. Generally, these laboratories test equipment for safe use in the workplace, but some test residential gas stoves.
- **Department of Energy:** The department issued a statement in January 2024 that it would update gas stove efficiency standards, among other consumer cooking products. It then issued a direct final rule in February 2024 to codify new standards.[13] It worked with manufacturing representatives and other stakeholders to finalize energy conservation standards, taking into account technological and economic considerations.
- **HUD:** HUD established and enforces construction and safety standards for manufactured homes (which make up approximately 7 percent of occupied housing stock nationwide). Based on analysis of recommendations from the Manufactured Housing Consensus Committee (a Federal Advisory Committee), HUD updates the Manufactured Home Construction and Safety Standards, which includes gas appliance and ventilation considerations. HUD also makes safety recommendations through its Healthy Homes Program, such as choosing exterior-vented appliances when possible, installing local exhaust ventilation for indoor combustion appliances, and limiting or avoiding the use of gas ovens or ranges to heat homes altogether.

What actions have others taken to improve gas stove safety?

Other organizations and subject matter experts have contributed to advancing gas stove safety through research and the development of testing methodologies. Several organizations and researchers have studied factors that affect indoor air quality. For example, Lawrence Berkeley National Laboratory researchers have studied emissions from gas stoves, focusing on the variability

in emissions levels that can occur. This research helps identify the factors influencing gas stove emissions and potential mitigation measures.

Additionally, efforts continue to improve ventilation methods. For instance, ASTM International states it has undertaken efforts to modernize and update testing methods for measuring the effectiveness of ventilation hoods. These efforts focus on quantifying the efficiency, or capture rate, of range hoods. For example, the performance of range hoods varies considerably based on factors such as fan airflow and the extent to which the hood covers the gas burners on a cooktop—a hood that fully covers all burners typically achieves a higher capture rate than one that partially covers them. Other industry participants are incorporating new technologies into range hoods to automatically activate the exhaust fan through sensors.

What challenges exist to future improvements in gas stove safety?

Our review of safety improvement efforts by industry and government organizations identified several challenges to improving gas stove safety, including regulatory, economic, consumer, and technological factors:

Regulatory fragmentation. The safety standards for gas stoves and for ventilation are developed by different standards development organizations. The interconnectedness of the two issues presents a coordination challenge and requires collaboration to effectively integrate emissions and ventilation considerations together.

Economic considerations. Evolving product safety and ventilation standards present economic challenges. While new products and construction projects can more easily accommodate enhancements, updating or retrofitting existing appliances or ventilation systems can be cost prohibitive, especially in older buildings. Further, advanced features, such as sensors that automatically activate exhaust fans when the stove is in use, may face market adoption barriers due to high upfront costs.

Consumer behavior. Consumer behavior also affects the safety of gas stoves. For example, the effectiveness and benefit of a vent hood above a cooktop is reduced if the users seldom turn it on while cooking. Other behaviors, such as the placement of pots and pans, also affect ventilation. For example, ventilation devices generally capture more emissions from the back burners than the front burners, according to some researchers.

Technological issues. Efforts to incorporate new technologies and enhance standards for gas stoves and ventilation are ongoing and interrelated. Given the multiple stakeholders involved and the interconnectedness of stove and ventilation issues, coordination and collaboration among different standards development organizations, government entities, and industry participants will be essential for advancing gas stove safety.

Agency Comments

We provided a draft of this report to CPSC, EPA, HUD, and the Department of Energy for review and comment. The agencies provided technical comments, which we incorporated as appropriate. CPSC also provided a letter, reproduced in this report. The agency noted that it has no plans to advance any rule to ban gas stoves, or to pursue any other mandatory standards that would limit consumer choice with respect to this product category.

How GAO Did This Study

For this work, we conducted a literature review to identify studies, articles, and other publications from industry, academia, health organizations, and government sources relevant to the safety of gas stoves. We reviewed documentation and conducted interviews with representatives of federal agencies (CPSC, EPA, HUD, and the Department of Energy) and standards development organizations (CSA Group, International Code Council, and ASHRAE).

In addition, we interviewed representatives of UL Solutions, which tests and certifies appliances for compliance with safety standards; ASTM International, which develops laboratory test methods; and RMI, an energy-focused nonprofit. We also interviewed representatives of three industry associations (Association of Home Appliance Manufacturers, National Apartment Association, and National Association of Home Builders) and two appliance manufacturers, as well as two academic researchers.

We conducted this performance audit from April 2024 to March 2025 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

List of Addressees

The Honorable Bill Hagerty
Chair
The Honorable Jack Reed
Ranking Member
Subcommittee on Financial Services and General Government
Committee on Appropriations
United States Senate

The Honorable Dave Joyce
Chairman
The Honorable Steny H. Hoyer
Ranking Member
Subcommittee on Financial Services and General Government
Committee on Appropriations
House of Representatives

We are sending copies of this report to the appropriate congressional committees, the Acting Chairman of the Consumer Product Safety Commission, Administrator of the Environmental Protection Agency, Secretary of Housing and Urban Development, and Secretary of Energy. In addition, the report is available at no charge on the GAO website at http://www.gao.gov.

Comments from the Consumer Product Safety Commission

UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
4330 EAST WEST HIGHWAY
BETHESDA, MD 20814
ACTING CHAIRMAN PETER A. FELDMAN

February 26, 2025

Sent via E-mail
Ms. Alicia Puente Cackley
Director
Financial Markets and Community Investment
Government Accountability Office

Re: GAO Engagement No. 25-107514

Dear Ms. Cackley:

I appreciate the opportunity to engage with GAO on your report titled *Gas Stoves: Risks and Safety Standards Related to Products and Ventilation*, (GAO-25-107514). The United States Consumer Product Safety Commission (CPSC) is a federal safety agency with a mission to reduce the unreasonable risk of injury from consumer products. I write to highlight that CPSC has no plans to advance any rule to ban gas stoves, or to pursue any other mandatory standards that would limit consumer choice with respect to this product category. On March 7, 2023, the Commission published a Request for Information (RFI) on Chronic Hazards Associated with Gas Ranges. The comment period on this RFI closed in May 2023, and I consider this matter concluded.

As GAO notes in its report, millions of Americans use gas stoves every day. In fact, American families have been using gas stoves, cooktops, and ranges, for years and largely without incident. CPSC will, of course, continue to pursue safety recalls on a case-by-case basis under our statutory authority, for example manufacturing defects that could result in fires, burns, explosions and carbon monoxide exposure. But as GAO also notes, there is ongoing disagreement about the extent of the linkage between the emissions produced by gas stoves and certain health issues. For these reasons, I believe CPSC's attention and limited resources are better focused on the agency's core safety mission, not backdoor climate regulation.

Again, I thank GAO for the opportunity to provide comments on this report.

Sincerely,

Peter A. Feldman
Acting Chairman

GAO Contact Information

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Reardon, Deena Richart, Franklin Rusco, Lindsay Shapray, Tristan Shaughnessy, Jena Sinkfield, Jack Wang, and Kristen Watts.

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Endnotes

[1]In this report, we refer to industry participants as entities involved in the development, manufacture, testing, sale, installation, and servicing of gas stoves in residential dwellings.

[2]In addition to emitting nitrogen dioxide, carbon monoxide, and particulate matter, gas stove cooking can also emit methane, benzene, and other gases. In this report, we focus on carbon monoxide, nitrogen dioxide, and particulate matter because they are described by the Environmental Protection Agency (EPA) as major pollutants from gas stoves. In January 2023, the Chair of the Consumer Product Safety Commission (CPSC), Alexander Hoehn-Saric, issued a statement that CPSC was researching gas emissions in stoves and engaged in strengthening voluntary safety standards for gas stoves. He also affirmed that the agency was not seeking to ban gas stoves.

[3]EPA regulates outdoor air quality, setting an acute outdoor air exposure limit for nitrogen dioxide at 100 parts per billion over 1 hour. Also, the World Health Organization recommends a 1-hour exposure limit at 200 micrograms per cubic meter (approximately 100 parts per billion) for both indoor and outdoor air. One study found that nitrogen dioxide levels exceeded these limits particularly in small homes or those with enclosed kitchens. See Singer, B. C. et al., "Pollutant concentrations and emission rates from natural gas cooking burners without and with range hood exhaust in nine California homes," *Building and Environment*, vol. 122 (2017): 215–229. Similar findings were reported by Kashtan, Y. et al., "Nitrogen dioxide exposure, health outcomes, and associated demographic disparities due to gas and propane combustion by U.S. stoves," *Science Advances*, vol. 10, no. 18 (2024).

[4]Lin, W. et al., "Meta-analysis of the effects of indoor nitrogen dioxide and gas cooking on asthma and wheeze in children," *International Journal of Epidemiology* (2013).

[5]This study was funded by the American Gas Association. It raised concerns about the causal conclusions of the Lin et al. meta-analysis because it was based on studies that only tested correlation. See Li, W. et al., "Gas cooking and respiratory outcomes in children: A systematic review," *Global Epidemiology*, vol. 5 (2023).

[6]The Consumer Product Safety Act created CPSC to regulate consumer products and address those that pose an unreasonable risk of injury; assist consumers in evaluating the comparative safety of consumer products; and promote research and investigation into the causes and prevention of product-related deaths, injuries, and illnesses. 15 U.S.C. §§ 2051—2089. CPSC is empowered to carry out these goals through a combination of monitoring, research, standard-setting, and enforcement. Some products under CPSC's jurisdiction are regulated (i.e., subject to mandatory standards established by CPSC through regulations). Many other products, including gas stoves, are subject to voluntary standards, which are generally determined by standard-development organizations with input from government representatives and industry groups. CPSC is an independent regulatory commission with a maximum of five members, one of whom serves as the Commission's Chair.

[7]Canadian Standards Association/American National Standards Institute, CSA/ANSI Z21.1–*Household Cooking Gas Appliances*.

[8]International Code Council, *International Residential Code (IRC).* The code references the standards of the American Society of Heating, Refrigerating and Air-Conditioning Engineers in its ventilation standards.

[9]ASHRAE 62.2–*Ventilation and Acceptable Indoor Air Quality in Residential Buildings*.

[10]A manufactured home (formerly known as a mobile home) is built to the Manufactured Home Construction and Safety Standards (HUD Code) and displays a red certification label on the exterior of each transportable section.

[11]The term "substantial product hazard" is defined in the Consumer Product Safety Act as “(1) a failure to comply with an applicable consumer product safety rule under this chapter or a similar rule, regulation, standard, or ban under any other Act enforced by the Commission which creates a substantial risk of injury to the public, or (2) a product defect which (because of the pattern of defect, the number of defective products distributed in commerce, the severity of the risk, or otherwise) creates a substantial risk of injury to the public.” 15 U.S.C. § 2064(a). CPSC has several tools available to respond to substantial product hazards, including negotiating or ordering corrective actions from firms. See GAO, *Consumer Product Safety Commission: Actions Needed to Improve Processes for Addressing Product Defect Cases,* GAO-21-56 (Washington, D.C.: Nov. 19, 2020).

[12]CSA Group has initiated two research projects related to gas stoves. The first project focuses on analyzing direct gas range emissions, using a proposed testing protocol that includes a range hood installed above the range surface. The second project involves proposed testing in a chamber to measure emissions in a controlled environment. The results of the chamber testing will be correlated with the range hood tests to determine how a gas range affects indoor air quality under ideal conditions.

[13]In February 2023, the Department of Energy issued a supplemental notice of proposed rulemaking attempting to change energy standards for gas cooking tops, but it was withdrawn. *Energy Conservation Program: Energy Conservation Standards for Consumer Conventional Cooking Products,* 88 Fed. Reg. 6818 (Feb. 1, 2023). It later issued a direct final rule with less stringent standards that the Department implemented. *Energy Conservation Program: Energy Conservation Standards for Consumer Conventional Cooking Products*, 89 Fed. Reg. 11434 (Feb. 14, 2024).