

Residential Cooking IAQ Special Report: Review of Claims Against Residential Cooking with Natural Gas



By: Frank Johnson - GTI

Summary

Information has been released to the public that implies, or directly states the use of natural gas as an energy source for cooking creates harmful or dangerous emissions in a residential environment. The articles and papers suggest that electric is much safer than gas and much more efficient. While some of the claims hold some scientific value and are backed up with credible results, other aspects of the articles and paper are misleading, incorrect or imply an advantage of electric over gas that does not exist. Below is a brief summary compiled by GTI for several of these reports. A comprehensive response to some of these articles is available from AGA in Fact Sheet Combustion Emissions from Residential Gas Ranges REV. 11.28.2019.

National Publications

Several national publications and news sources including Washington Post, LA Times, Western Wire, NY Times, New Yorker, Reuter and NPR have published articles related to cooking with natural gas and indoor air quality (IAQ). The articles focused on health concerns (mostly asthma) and climate change related to greenhouse gases associated with combustion. Most were very negative toward natural gas and promoted electric cooking as the solution.

Main Issue: These articles are generally presented as scientific studies but were mostly published in the editorial section and are obviously opinion pieces with little or no discussion of data for which the opinions are based on and were not peer reviewed for content and accuracy.

Scientific Publications

GTI reviewed over 30 articles that were published in journals or conference proceedings with a focus on NO_x being an asthma cause or trigger. The main articles were Lin 2013, Krasner 2019, Belanger 2013, Singer 2016, HEET 2019 and Garrett 1998. The latter being the most referenced. The best comprehensive article was “Clearing the Air” from National Academy of Medicine. which used proven data analysis to review the information. A complete list of references is available by request.

Main Issues: Based on established scientific practices and in GTI’s opinion, many of the publications had questionable conclusions on NO_x and asthma. Specifically making conclusions about the relationship between cooking with natural gas and asthma that appeared to be more coincidence than causality. The articles also tended to use implied results from several studies to make a single conclusion against natural gas when none of the articles make a definitive claim on the causes of asthma and stated that more research is needed. Specific to Singer 2016, the report did not include NO_x emissions data from the oven and data on how NO_x disperses from the oven into the living environment. Basically, no attempt was made to correlate the NO_x emissions from the oven to total value of measured NO_x in the home. Another almost universal conclusion from the reviewed articles was that proper ventilation for both gas and electric cooking greatly improved IAQ, but usually concluded that eliminating natural gas was the best solution.

UCLA/Sierra Club Report

On April 28, 2020 the UCLA Fielding School of Public Health Department of Environmental Health Sciences released a report and conducted a seminar funded by the Sierra club entitled, “Effects of Residential Gas Appliances on Indoor and Outdoor Air Quality and Public Health in California.” The report was prepared for the Sierra Club and was not peer reviewed before release. A disclaimer on the report states, “The views, opinions, findings, and conclusions or recommendations expressed in this report are strictly those of the authors. They do not necessarily reflect the views of the Sierra Club and/or

Residential Cooking IAQ Special Report: Review of Claims Against Residential Cooking with Natural Gas

authors' affiliated institutes." The report is similar in format as Lin (2013), using compiled information from several reports and attempts to draw conclusions. No new primary emission measurements were made as part of this effort. The main conclusion is if all residential gas appliances were transitioned to electric, the reduction in particulate matter (PM) emissions would result in 354 fewer deaths and \$3.5 billion in monetized health benefits for just one year. The results are based on a model using existing data and EPA's BenMAP community edition tool.

Main Issues: After reviewing the report and listening to the webinar, GTI has identified several issues with the research and the conclusions drawn. The main issues are:

- No new NO_x data were presented and data for source emissions from ranges were not documented
- Operation times of 1 hour and 2 hours with the range top and oven burners on were used in the study, which differs greatly from typical operations. According to USDA, a family spends an average of 38 minutes on meal preparation per day. This includes food prep, cooking, and serving time
- The death rate is based on PM_{2.5} emissions where 40% of NO_x is assumed converted to Nitric PM_{2.5}. Justification or substantiation of this method is not included in the report.
- Like previous reports, it identifies that proper ventilation greatly improves IAQ but focuses on electrification as the solution
- The report does not include any data on PM_{2.5} generated by electric cooking
- The value of electrification includes the monetized health benefits, but no estimates of the cost of electrification
- All electric power in the study is assumed to be from non-fossil fuel sources
- The Mean Emission Factor (EF) used in the study only calculates improvements based on replacing natural gas with electric and does not include estimation of how emissions could be reduced by using advanced burner systems with improved efficiency and emissions
- The report extensively uses EPA 2016 as a reference, but also states in the report, "The 2016 US EPA Integrated Science Assessment (ISA) on the health effects of NO_x found the literature to be suggestive of a causal relationship between chronic NO₂ exposure and respiratory effects, cardiovascular effects, cancer, and mortality, though it did not make an absolute determination"

The report also includes outdoor air quality information based on natural gas furnaces and water heaters. A review of that information is not included in this report.

Next Steps

Based on the results of the literature review of existing studies of IAQ associated with residential cooking with natural gas, GTI has identified the following as missing from existing data and are essential information needed to accurately assess the impact cooking with natural gas has on residential IAQ:

- Accurate data on NO_x emissions from residential ranges using establish ASTM or SCAQMD protocols
- Data on particulate matter (PM) emissions for both gas and electric cooktops and determination of the relationship between NO_x and PM_{2.5}
- Quantification of how improved ventilation and improved oven burner technology in terms of efficiency and emissions could improve IAQ
- Quantification of the cost of electrification of residential cooking

Residential Cooking IAQ Special Report: Review of Claims Against Residential Cooking with Natural Gas

Additional Information

Before the UCLA/Sierra Club report, AGA issued a Fact Sheet addressing the concerns and issues in several of the articles published. Fact Sheet Combustion Emissions from Residential Gas Ranges REV. 11.28.2019 is available at the following link ([AGA Fact Sheet](#)). Additional resources have been provided by Stuart Saulters of APGA at [APGA Discussions](#).

Direct links to the resources are:

[Implications of Policy-Driven Residential Electrification](#)

[Combustion Emissions from Residential Gas Ranges](#)

[Household Air Pollution and Health: World Health Organization](#)

[Natural Gas: A Winning Strategy to Improve U.S. Indoor Air Quality](#)

[Sacramento Utility Employee's Pro-Electrification Argument Doesn't Hold Up to the Facts](#)

[Ventilation and Air Quality in New California Homes with Gas Appliances and Mechanical Ventilation](#)

Contact Information:

Frank Johnson, PhD
GTI - R&D Manager, Residential and Commercial Foodservice
1700 S. Mt. Prospect Rd.
O:+1 847.768.0670 M: +1 847.281.6966