

February 11, 2022

TO: Eric D. Lebel  
Department of Earth System Science, Stanford University

CC: Colin J. Finnegan  
Zutao Ouyang  
Robert B. Jackson

I am writing on behalf of the American Gas Association (AGA), which represents more than 200 local energy companies that deliver natural gas throughout the United States. There are more than 77 million residential, commercial and industrial natural gas customers in the U.S., of which 96 percent receive their gas from AGA members. AGA is an advocate for natural gas utility companies and their customers and provides a broad range of programs and services for its member natural gas pipelines, marketers, gatherers, international natural gas companies, and industry associates. The AGA and its members prioritize safety and strive every day to continue to advance the safety of customers, communities, and employees.

We read with interest the publication of "Methane and NO<sub>x</sub> Emissions from Natural Gas Stoves, Cooktops, and Ovens in Residential Homes" in *Environmental Science & Technology* on January 27, 2022. The industry shares a goal of helping to ensure safe operations and minimizing overall environmental impacts. To that end, we would like to understand better the data set that was generated and the methodology and analysis supporting the study's findings. We are requesting additional supplementary information from your study by way of this communication.

We would appreciate it if you would provide responses or more information related to the following at your earliest possible convenience:

1. Calculated air changes per hour for the spaces created by the chamber at each residence tested. It is our understanding that these were used to correct or adjust the subsequent measurement data.
2. Background measurements of CH<sub>4</sub> and NO<sub>x</sub> collected at each residence tested.
3. The number, magnitude and distribution of negative values obtained for steady-state-off emissions.
4. List of specific instruments, i.e., manufacturer, model number, etc., used for the air sampling and general location of the instrument's sampling probe at each location.
5. Results for instrument calibrations along with zero and upscale calibration checks.
6. Results for other quality control instrument checks, such as drift checks.
7. Whether standing pilots were present and active on the range top units tested.

Additionally, we would appreciate responses to the following questions related to the data reduction and methodology at your earliest possible convenience:

1. What was the high standard used to calibrate the cavity ring-down spectrometer and demonstrate linearity at the top of its range?

2. For a given appliance, two to seven measurements were performed. What was the typical observed variability for a single appliance?
3. The paper indicates that nitrogen dioxide (NO<sub>2</sub>) was measured directly. How was that accomplished? It is our understanding that the instruments cited typically are used to measure NO<sub>x</sub> and nitric oxide (NO), with NO<sub>2</sub> calculated by difference rather than actually being directly measured.
4. Were the NO<sub>x</sub> results corrected or adjusted for the presence of nitrous acid or other interferents? And if so, how were those adjustments made?
5. Were the cavity ring-down spectrometer readings corrected or adjusted for the presence of volatile organic compounds (VOCs), hydrogen sulfide or other interferents?
6. What selection criteria were used for selecting the 53 residences that were tested?
7. Why were NO<sub>x</sub>/NO/NO<sub>2</sub> measured at only some of the 53 residences where CH<sub>4</sub> and carbon dioxide (CO<sub>2</sub>) were measured? If this was the result of a selection process, what criteria were used for that process?
8. Should the reported molar flows in Figure 3 of your articles have units of mmol/hr rather than mol/hr?
9. Were any data excluded as outliers? For example, the article mentions "one particularly large outlier – stove 19" for its CH<sub>4</sub> emissions from combined on/off pulse as it had a pilot light that took several seconds to ignite. Was the associated data excluded from relevant data distributions? Were outlier tests applied aside from the use of box-and-whisker plots?
10. Were any weighting factors applied when scaling up the 53 tested houses to generate annual emissions for the 43.3 million stoves and secondary cooktops in the U.S.? For example, were the study results weighted for the percentage of appliances with pilot lights or the age of the appliances in the study group versus for the U.S. overall?
11. Was the representativeness of the tested appliances and sufficiency of the size of the sample assessed with regards to the overall U.S. population of appliances?
12. Were the tested gas cooking appliances checked for proper operating rate?
13. What was the rationale for using mean values rather than the median or other values when extrapolating annual emission estimates?

Sound data and any extrapolation help inform how all stakeholders examine and work to reduce emissions to help achieve a cleaner energy future. There is no doubt that research like this can impact policy action and public sentiment. And I'm confident you would agree that it is important that there is a sufficiently full and fair exposition of the pertinent facts to enable the public to form independent conclusions.

We look forward to hearing back from you at your earliest possible convenience and hope we can work together to continue advancing safety and our shared environmental goals.

Thank you for your time and consideration.

Sincerely,

A handwritten signature in black ink, appearing to read "Richard Meyer". The signature is fluid and cursive, with a large initial "R" and "M".

Richard Meyer