Air quality and pollution have been a concern for many years. In the 1970s and ‘80s, it was discovered that the ozone layer above Antarctica was thinning, and it brought air pollution to the political center stage. The focus on reducing the emission of potentially dangerous gaseous compounds increased and grew from chlorofluorocarbons (CFCs) that were thought to be the cause of the “Ozone Hole” to Carbon Monoxide (CO) and Nitrogen Oxide Species (NO_x) due to their harmful effects on humans.

During that time, methods to detect low levels of CO and NO_x were developed. Gas chromatography has been used to measure levels of CO and NO_2 in the parts per million (ppm) range of air samples to understand air pollution processes.[1,2,3] Today, it has been found that several different occupations could potentially lead to high-level exposure of harmful organic compounds such as CO and NO_2, such as military combat situations or industrial equipment accidents. However, a new source might be exposing everyday citizens to lower, although potentially hazardous, levels of CO and NO_x: the gas stove.

Recent headlines have brought gas stove emissions and their potential harm to the forefront of the public eye. Natural gas combustion leads to the formation of CO, NO_2, and formaldehyde that can be released in the homes of gas stove users. Household CO detectors have been available for many years, but reliable NO_2 detectors have not been made available.

According to the CDC, 1 hour of exposure to 1,000 to 1,200 ppm of CO would cause unpleasant but not dangerous symptoms; however, that same dose can become dangerous after 1 hour.[4] Currently, the CDC does not have useful data on acute inhalation toxicity for NO_2 , but 100 to 150 ppm nitrogen oxides are dangerous for short exposures of 30 to 60 minutes.[5] Interestingly, a study in 2020 showed that NO_2 emissions from frying bacon on a

gas stove only reached a level of 104 ppb[6], and field technicians report that most kitchen ranges can be tuned to produce less than 50 ppm of CO when used.[7]

Although there is a degree of sensationalism to the news articles about the dangers of using gas stoves, combustion of natural gas does release pollutants into the air. Air pollution is always a concern in one's home, so better methods and detectors need to be developed to better measure levels of CO and NO_2 in the home.

If detection of organic compounds in gases are of interest to you and your next application, check out these sources:

GC Method Development Guide

Persistent Organic Pollutants by GC Guide

GC Troubleshooting Guide

References

1. Giannovario, J. A., Grob, R. L., & Rulon, P. W. (1976). Analysis of trace pollutants in the air by means of cryogenic gas chromatography. *Journal of Chromatography A*, 121(2), 285–294. https://doi.org/10.1016/s0021-9673(00)85025-6

2. Popp, P., & Oppermann, G. (1978). Determination of carbon monoxide concentrations in air by gas chromtography using an argon ionization detector. *Journal of Chromatography A*, 148(1), 265–268. https://doi.org/10.1016/s0021-9673(00)99346-4

3. Analysis of Organic Air Pollutants by Gas Chromatography and Mass Spectroscopy, EPA-600/2-77-100. Office of Research and Development, US Environmental Protection Agency, June 1977.

4. https://www.cdc.gov/niosh/idlh/630080.html

5. https://www.cdc.gov/niosh/idlh/10102439.html

6. https://www.statista.com/statistics/1169716/gas-stove-nitrogen-dioxide-emissions/

7. https://www.abe.iastate.edu/extension-and-outreach/carbon-monoxide-poisoning-gas-fired-kitchen-ranges-aen-205/