



Gas: A Major Source of Indoor Air Pollution

Most people know that gas leaks can be deadly, but fewer realize that gas appliances are a threat to health even without leaks. Like any fossil fuel, natural gas gives off pollutants when burned. The resulting mix of nitrogen dioxide (NO₂) and other pollutants can have serious health ramifications.

Nitrogen Dioxide causes a range of health problems

- A large body of evidence shows that NO₂ exposure results in increased respiratory symptoms, asthma attacks, and hospital admissions in people with asthma.ⁱ
- In addition to exacerbating asthma symptoms, long-term NO₂ exposure (measured over one or more years) is likely to *cause* asthma to develop, especially in children.¹
- Research also suggests that long-term average NO₂ exposure can increase the risk of diabetes, cancer, and premature mortality.¹
- Health Canada, Canada's federal health agency, notes that the relationship between health effects and NO₂ concentration seems to be linear, *with no safe threshold*. Health Canada concludes, "[I]t should be assumed that any increment in levels of ambient NO₂ presents an increased risk for health effects, up to and including mortality."ⁱⁱ

Gas heaters and stoves are a major source of indoor NO₂ pollution

- While NO₂ levels in homes with electric appliances are usually half outdoor levels, in homes with gas stoves or unvented space heaters, indoor levels often exceed outdoor levels.ⁱⁱⁱ
- To give a sense of the magnitude, the World Health Organization assumes that homes with no indoor NO₂ source have an average NO₂ level around 8 parts per billion (ppb), while the average in homes with a gas stove is around 22 ppb. The World Health Organization suggests a long-term limit of 20 parts per billion (ppb).^{iv} (pg 247)
- In studies of American homes with gas appliances, the average NO₂ level measured often exceeds the limit set by the World Health Organization.⁴ (pg 246), v., viii
- Cooking with a gas stove can also cause dangerous short-term NO₂ spikes. A simulation found that over 60% of homes using gas stoves without a range hood are likely routinely exposed to NO₂ levels above the EPA's 100 ppb 1-hour limit.^{viii} This is consistent with a recent study in which 4 out of 9 homes with gas stoves exceeded the 1-hour limit during cooking.^{ix}

Gas heaters and stoves emit enough NO₂ to cause measurable health problems

- Scientists have been able to tie the adverse health effects of NO₂ directly to gas stoves for more than four decades.^x
- For example, researchers measured NO₂ levels in the homes of Baltimore children with asthma. Their results suggest that, holding other factors constant, an asthmatic child in a house with a gas stove and gas heater would experience 10% more days of cough symptoms and 15% more days with wheeze-induced limited speech than an asthmatic child in a house with electric appliances.⁶
- A 2013 metanalysis of 41 studies examining the interaction between gas cooking, indoor NO₂ levels, and asthma found that children living in a home with a gas stove have a 42% increased risk of current asthma.^{xi}

- The World Health Organization's indoor air pollution guidelines were developed under the assumption that the expected NO₂ increase from a gas stove causes a 20% increased risk of lower respiratory illness in children.^{4 (p 247)}

To protect yourself, carefully ventilate and consider going electric

- To mitigate your indoor air pollution exposure, homes need to be well ventilated.^{8,xii}
- A range hood that exhausts air outside should always be used when cooking.⁸
- The safest option may be to ventilate *and* go electric. Studies have found higher levels of NO₂ in homes with gas stoves than homes with electric stoves even with proper ventilation.^{xiii} A randomized experiment found that installing range hoods above unvented gas stoves did not have a significant effect on NO₂ concentrations but replacing gas stoves with electric stoves reduced kitchen NO₂ levels by half.^{xiv}

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ⁱⁱ Health Canada. *Human Health Risk Assessment For Ambient Nitrogen Dioxide*. Government of Canada; 2016.

ⁱⁱⁱ Nitrogen Dioxide's Impact on Indoor Air Quality. US EPA. <https://www.epa.gov/indoor-air-quality-iaq/nitrogen-dioxides-impact-indoor-air-quality>. Published 2019. Accessed September 23, 2019.

^{iv} *WHO Guidelines For Indoor Air Quality: Selected Pollutants*. Regional Office for Europe; 2010. <https://app-s.who.int/iris/handle/10665/260127>. Accessed September 23, 2019.

^v Hansel N, Breyse P, McCormack M et al. A Longitudinal Study of Indoor Nitrogen Dioxide Levels and Respiratory Symptoms in Inner-City Children with Asthma. *Environ Health Perspect*. 2008;116(10):1428-1432. doi:10.1289/ehp.11349

^{vi} Belanger K, Gent JF, Triche EW, Bracken MB, Leaderer BP. Association of indoor nitrogen dioxide exposure with respiratory symptoms in children with asthma. *Am J Respir Crit Care Med*. 2006;173(3):297-303. doi:10.1164/rccm.200408-1123OC

^{vii} Diaz Lozano Patino E, Siegel J. Indoor environmental quality in social housing: A literature review. *Build Environ*. 2018;131:231-241. doi:10.1016/j.buildenv.2018.01.013

^{viii} Logue J, Klepeis N, Lobscheid A, Singer B. Pollutant Exposures from Natural Gas Cooking Burners: A Simulation-Based Assessment for Southern California. *Environ Health Perspect*. 2014;122(1):43-50. doi:10.1289/ehp.1306673

^{ix} Singer B, Pass R, Delp W, Lorenzetti D, Maddalena R. Pollutant concentrations and emission rates from natural gas cooking burners without and with range hood exhaust in nine California homes. *Build Environ*. 2017;122:215-229. doi:10.1016/j.buildenv.2017.06.021

^x Seltenrich N. Take care in the kitchen: avoiding cooking-related pollutants [published correction appears in *Environ Health Perspect*. 2015 Aug;123(8):A202]. *Environ Health Perspect*. 2014;122(6):A154-A159. doi:10.1289/ehp.122-A154

^{xi} Lin, W., Brunekreef, B. and Gehring, U. (2013). Meta-analysis of the effects of indoor nitrogen dioxide and gas cooking on asthma and wheeze in children. *International Journal of Epidemiology*, 42(6), pp.1724-1737.

^{xii} Primary National Ambient Air Quality Standards (NAAQS) for Nitrogen Dioxide. US EPA. <https://www.epa.gov/no2-pollution/primary-national-ambient-air-quality-standards-naaqs-nitrogen-dioxide>. Published 2018. Accessed September 23, 2019.

^{xiii} Dédelé, A. and Miškinytė, A. (2016). Seasonal variation of indoor and outdoor air quality of nitrogen dioxide in homes with gas and electric stoves. *Environmental Science and Pollution Research*, 23(17), pp.17784-17792.

^{xiv} Paulin, L., Diette, G., Scott, M., McCormack, M., Matsui, E., Curtin-Brosnan, J., Williams, D., Kidd-Taylor, A., Shea, M., Breysse, P. and Hansel, N. (2014). Home interventions are effective at decreasing indoor nitrogen dioxide concentrations. *Indoor Air*, 24(4), pp.416-424.