Home is Where the Pipeline Ends

Study measuring air pollutants and odorants in natural gas used in homes

HARVARD T.H. CHAN SCHOOL OF PUBLIC HEALTH | C-CHANGE CENTER FOR CLIMATE, HEALTH, AND THE GLOBAL ENVIRONMENT

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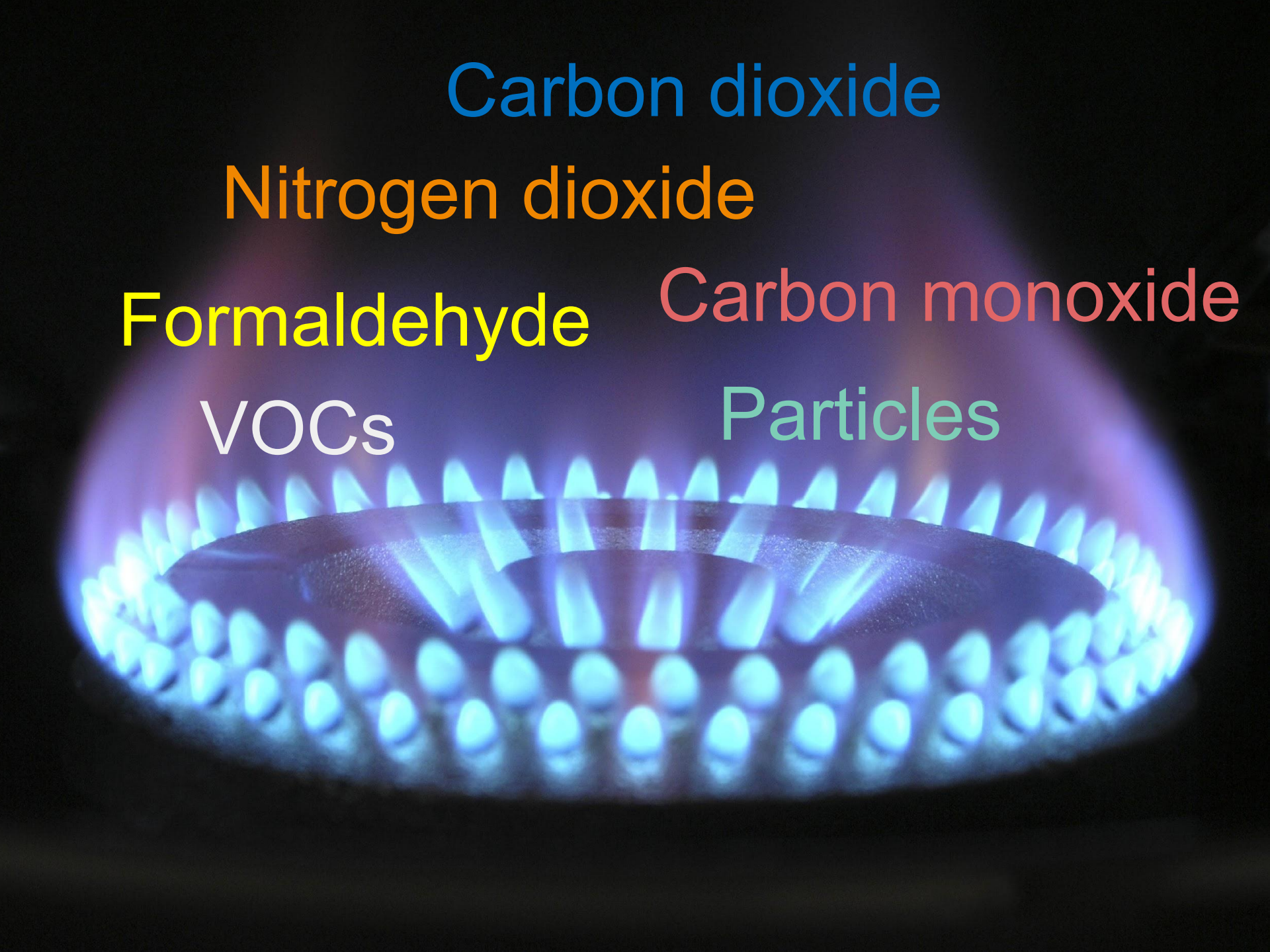

Carbon dioxide
Nitrogen dioxide
Carbon monoxide
Formaldehyde
VOCs
Particles

The New York Times

Did I Turn Off the Stove? Yes, but Maybe Not the Gas

New research finds that gas stoves emit methane, a potent greenhouse gas, even when turned off and adds to the debate over electrifying homes.

Lebel, E. D., Finnegan, C. J., Ouyang, Z., & Jackson, R. B. (2022). Methane and NO x Emissions from Natural Gas Stoves, Cooktops, and Ovens in Residential Homes. *Environmental science & technology*, *56*(4), 2529-2539.

If natural gas is leaking…

What else is in gas?

Findings

1) Natural gas used in homes contains numerous Air Toxics

- Detected 21 different air toxics; including benzene (95% detection)
  - Concentrations are low and are not an immediate cause for concern
    (1) But important given widespread use of gas indoors
  - Significant fluctuation across Boston communities and over time
  - Winter peak: 3X higher than spring; 8X higher than summer

2) We could be exposed to small leaks without knowing it

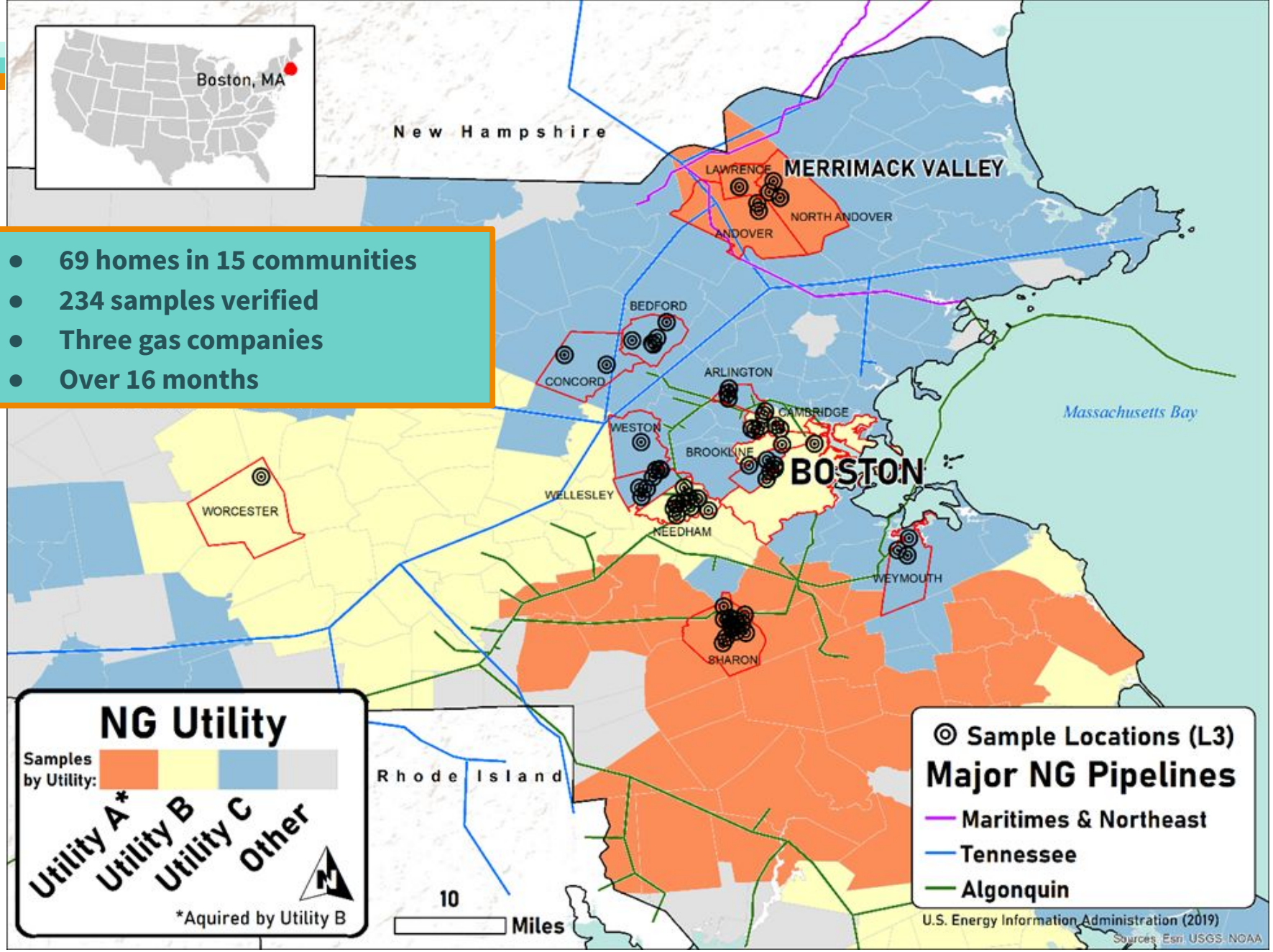
- Natural gas odorants vary
  - All samples met federal & MA odorization guidelines
  - Lower winter the odorant levels = potential for larger leaks without smell
  - May help explain how small leaks = large amounts of gas leaked in cities

3) Leaking natural gas impacts climate and now maybe health

- Hazard ID study: Any impacts to air quality or health require leaks (not studied)
  - Any impacts would be additive to known post-combustion pollution
- Winter = higher toxics in gas, higher gas usage, more time inside, less ventilation
- Air toxics in fossil methane make it distinct from other sources of methane
  - Co-pollutants in our energy system are important for health & policy

Methods


FINI
Balsamic
Vinegar
of Modena



- 69 homes in 15 communities
- 234 samples verified
- Three gas companies
- Over 16 months

Research in Context

Natural gas is not as clean as we thought

Gas Leaks, Climate Change & Health

Methane leaks are a known climate risk

- Methane is the second largest contributor to climate change
- Meeting 1.5°C requires reducing emissions 4x faster than the rate they grew
  - Methane reductions can buy us time, but levels are still climbing
  - ~2.5% of gas delivered to Boston region is lost each year
  - Decarbonizing homes and buildings is especially challenging

Natural gas leaks are an unknown & uncertain health risk

- This study reveals previously unaccounted for source of hazardous pollutants
- 1 in 20 study participants had a leak that required fixing
  - Health risks are not zero, and likely on par with other indoor sources
- 10,000 known leaks in Massachusetts
  - Contributing to outdoor air quality impacts as well

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Natural Gas and Health

- ***Health Risk***
  - Can't estimate from this study
  - Probably not zero, but less than other environmental hazards like tobacco smoke
- ***Hazard & Exposure***
  - Human health hazards can produce a health risk *if* people are exposed
  - We only measured whether a hazard is present (i.e., benzene in gas)
  - However, we know that natural gas appliances can leak gas
- ***Implications for Health***
  - Health risks from residential natural gas use *could* result from exposure to both burned and unburned gas, but more research is needed

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Conclusions & Recommendations

Individual and Policy Actions to Mitigate Risk

Conclusions & Recommendations

Conclusion: The gas supply is not as clean as we thought

- Monitor & report a more detailed composition of natural gas
- Reduce potential indoor air impacts by filtration and ventilation
- Reduce potential indoor air impacts by removing leaks and potential sources

Conclusion: Very small gas leaks can be odorless

- Investigate natural gas odorization practices to address variability
- Survey homes for small leaks (licensed plumber or appliance installers)
- Odorant detection requirements could be set to a lower threshold

Conclusion: We have more to learn about gas and health

- More research needed on gas leak exposures in occupational settings
- Only know what we measure: Other classes of chemicals may be present
- Many VOCs likely natural in origin – cities closer to extraction may differ

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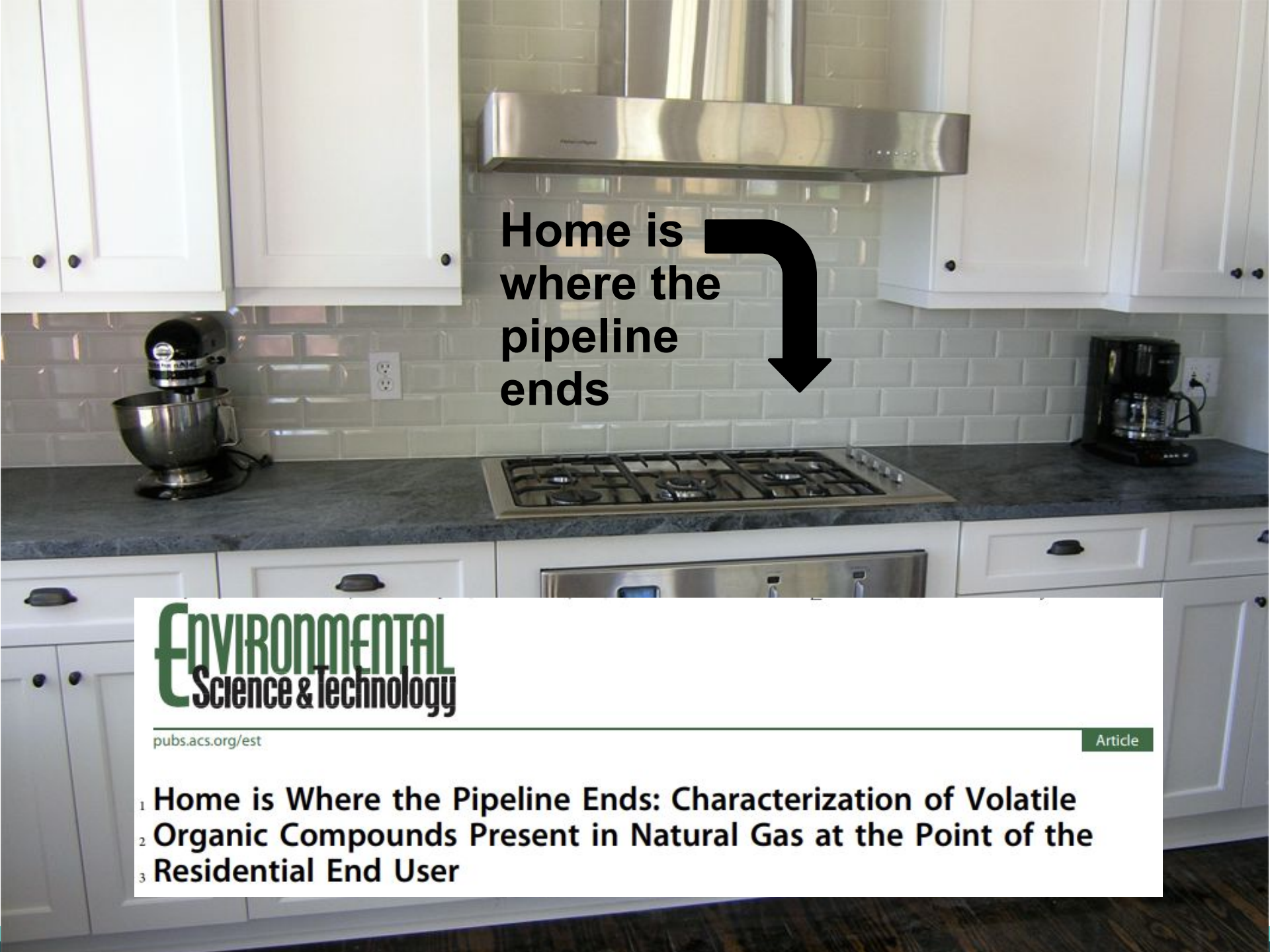

ENVIRONMENTAL Science & Technology

pubs.acs.org/est

Article

Home is Where the Pipeline Ends: Characterization of Volatile Organic Compounds Present in Natural Gas at the Point of the Residential End User

Resources

Websites:
https://www.psehealthyenergy.org/our-work/publications/archive/home-is-where-the-pipeline-ends/
https://www.hsph.harvard.edu/c-change/news/home-is-where-the-pipeline-ends/

DOI: https://doi.org/10.1021/acs.est.1c08298

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