

New York City, USA

Identifying and eliminating a leading source of pollution using enhanced local air quality monitoring

Case study developed in partnership with the New York City Department of Health and Mental Hygiene



<p>8.3 million New York City population size</p>	<p>1.6 times the WHO air quality guideline of $5 \mu\text{g}/\text{m}^3$ ($8 \mu\text{g}/\text{m}^3$ annual average $\text{PM}_{2.5}$ concentrations)</p>	<p>\$80,410 National GDP per capita PPP</p>	<p>5,007 MtCO₂e National greenhouse gas emissions per capita</p>
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Sources of emissions



Commercial Cooking



Industry



Transportation
(Non-Public)



Building Heating

Commercial cooking is the leading source of PM_{2.5} emissions in New York City

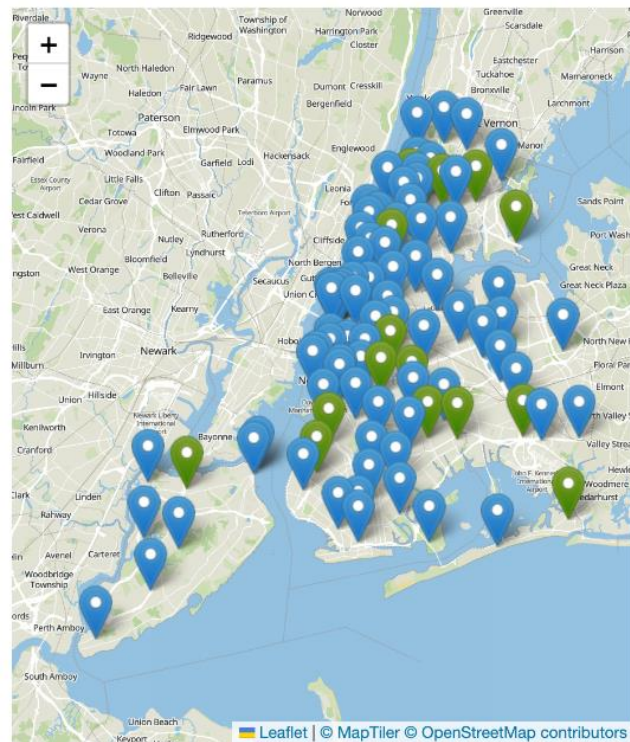
Overview

New York City established its first sustainability plan in 2007, envisioning a city committed to growth and carbon mitigation. The city's Department of Health and Mental Hygiene successfully argued for the importance of a robust system to evaluate local sources of air polluting emissions and track their trends. As a result, the city established the New York City Community Air Survey (NYCCAS) program, which designed and deployed across the city lamppost-mounted air pollution monitoring devices to measure key pollutants. NYCCAS marked the first time the health department was responsible for monitoring ambient air quality. This decision reflected a growing understanding that a significant health burden from air pollution occurs even at levels of pollution that may be compliant with standards, but still too high for safety. By giving responsibility to the health department, the city recognized that policy improvements would need to be driven by health concerns and by the potential for health benefits.

NYCCAS data is used to:

- Help inform New York City's sustainability plan
- Estimate the health impact of exposures and the health benefits from policy options
- Drive legislative and regulatory changes to reduce local sources of emissions
- Track changes in air quality over time
- Inform the public about local topics such as recent air quality improvements, climate-friendly initiatives like car-free zones, and changes in the sources of air pollution
- Highlight disparities in exposures and health impacts across NYC neighborhoods
- Provide high-quality data to academic investigators for air quality studies

NYCCAS is the largest ongoing urban air monitoring program of any U.S. city and has been measuring citywide fine particulate matter, nitrogen dioxide, nitric oxide, black carbon, wintertime sulfur dioxide and summertime ozone for more than a decade. Since the inception of the program in 2008, there has been a remarkable decrease in air pollution levels.



Location of NYCCAS network sensors. *Blue markers* are locations selected based on their pollution characteristics—industrial, residential, commercial, and high traffic areas. *Green markers* are newly added sites with populations at greater risk of air quality-related health impact.

and

Where there are no monitors, air quality data is approximated using a land-use regression model. This means integrating data on factors known to influence air quality, including land use, population and building density, traffic, and other natural and built environmental characteristics.

Data from NYCCAS is routinely analyzed and made available to the public on a dedicated [website - https://www.nyc.gov/site/doh/data/data-sets/air-quality-nyc-community-air-survey.page](https://www.nyc.gov/site/doh/data/data-sets/air-quality-nyc-community-air-survey.page). The website is used to highlight pollution trends and reveal beneficial impacts of air quality regulations to garner more support for climate-friendly policies.

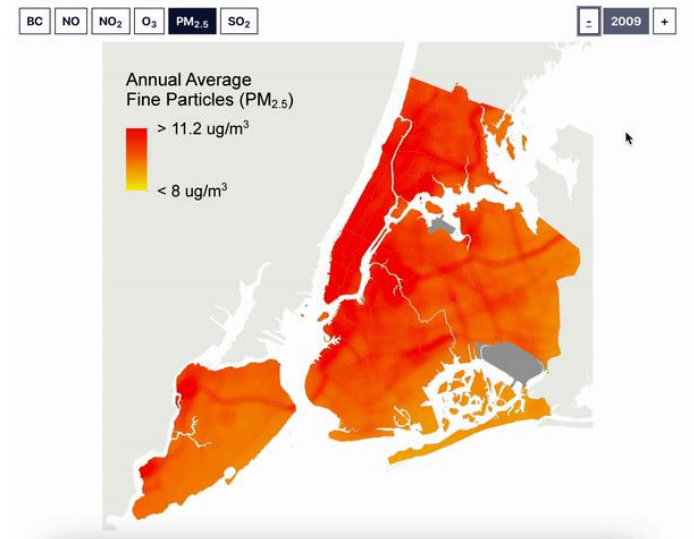
Impact

NYCCAS data has been used to identify and address leading sources of pollution in the city. For example, NYCCAS's first ever report in 2009 on wintertime air quality identified high levels of pollution in areas where buildings were using residual fuel oil for heating (i.e., heavy oil). These sulfur-heavy oils were a major source of sulfur dioxide (SO₂) in New York City. The health department estimated the number of lives lost and hospitalizations caused by this source and used the data to convince the mayor's office to support a rapid phase-out, resulting in the Clean Heating Law of 2010 that mandated use of cleaner fuels for residential buildings by 2015.

But changing the law was not enough. Because building owners were expected to fund the upgrades themselves, NYCCAS data were also used to identify economically disadvantaged neighborhoods where compliance would be more difficult. The neighborhood-scale data on air pollution and disproportionate health impacts helped the city prioritize neighborhoods for financial assistance for converting to cleaner fuel technology.

Table: Decline in Air Pollution From 2008 to 2021

Pollutant	Decrease in %
Fine Particles (PM _{2.5})	↓ 40%
Nitrogen Dioxide (NO ₂)	↓ 38%
Nitric Oxide (NO)	↓ 58%
Sulfur Dioxide (SO ₂)	↓ 97%



Changes in PM_{2.5} levels over time using annual average pollution maps. Source: <https://a816-dohbep.nyc.gov/IndicatorPublic/beta/key-topics/airquality/nyccas/>

"Focusing on what the data is telling us is critical. Being able to say that commercial cooking contributes to higher levels of PM in some NYC neighborhoods so let's push hard on this, is ultimately what matters"



Sarah Johnson

Executive Director, Air Quality Program, New York City Department of Health and Mental Hygiene

Continued monitoring by NYCCAS revealed that air quality improved significantly after the law, resulting in the prevention of an estimated 290 premature deaths, 180 hospital admissions for respiratory and cardiovascular disease, and 550 emergency department visits for asthma each year.¹

NYCCAS also identified restaurant emissions as an important unregulated source of local emissions. The use of char broilers and open-fire grills in restaurants contributed a significant proportion of the city's ambient PM_{2.5} pollution. The combined evidence of emissions and their health impacts led to local regulations requiring the phase-in of emissions control devices in restaurants.

There have been many other significant wins. New York City's record of promoting rules to curtail greenhouse gas emissions has been informed by NYCCAS' efforts to estimate the health and economic co-benefits of these laws. The NYCCAS team continues to work with the Mayor's Office of Climate and Environmental Justice to identify indicators (such as asthma-related emergency department visits attributable to air pollution) to prioritize neighborhoods for interventions where the health impacts of air pollution are the highest. Originally funded with mayoral discretionary funds, NYCCAS is now mandated by law following the New York City Council's passage of Local Law 103 of 2015, which amended the city's administrative code to require the health department's air quality monitoring and annual reporting of findings.

¹ Kheirbek, Iyad, Jay Haney, Sharon Douglas, Kazuhiko Ito, Steven Caputo Jr, and Thomas Matte. "The public health benefits of reducing fine particulate matter through conversion to cleaner heating fuels in New York City." *Environmental science & technology* 48, no. 23 (2014): 13573-13582.

Health Highlights

- NYCCAS marked the first time the health department was responsible for monitoring ambient air quality in the city. This decision reflected a growing understanding that a significant health burden from air pollution occurs even at levels of pollution that may be compliant with standards, but still too high for safety. By giving responsibility to the health department, the city recognized that policy improvements would need to be driven by health concerns and by the potential for health benefits.
- The hyper-local air quality data from the NYCCAS network helped the city identify a leading source of pollution, i.e., residential heating fuel. The health department estimated the number of lives lost and hospitalizations caused by this source and used the data to convince the mayor's office to support a rapid phase-out, resulting in the Clean Heating Law of 2010 that mandated use of cleaner fuels for residential buildings by 2015.
- Continued monitoring by NYCCAS revealed that air quality improved substantially after the law came into force, resulting in the prevention of an estimated 290 premature deaths, 180 hospital admissions for respiratory and cardiovascular disease, and 550 emergency department visits for asthma each year.

Lessons Learned

- Air quality evaluation is an essential component of climate action planning, as health and economic co-benefits of emissions curbs can serve to support climate laws.
- It's important to have clarity about the purpose of air quality monitoring. The type of air quality monitoring system needed should be determined by what questions the monitoring data is expected to address, such as identifying pollution sources, evaluating geographically targeted clean air interventions, etc.
- A city may be compliant with air quality guidelines, but there remains significant opportunity for further improvements to influence population health.
- The investment of resources to characterize key local sources of air pollution yields a huge return when the health benefits of air quality improvement are factored in.



Commercial cooking in New York City is a leading source of emissions for the city.

- Making routine air quality data publicly available is critical for clean air action. In addition, it is crucial to make sure there

are sufficient staff and other resources to analyze the data and identify actionable paths for a range of audiences.

- Sharing data is only meaningful if there is an audience and the information is presented in a way the audience can understand. New York City conducts community meetings and journalist trainings and offers school curricula to build a group of data users.

Strategic Partners

The city would like to acknowledge the following partners in supporting its clean air and climate journey:

- Barry Commoner Center for Health and the Environment, Queens College City University of New York
- NYC Mayor's Office of Climate & Environmental Justice
- NYC Department of Environmental Protection
- New York State Department of Environmental Conservation
- New York State Energy Research and Development Authority