Sites of Concern: Air Quality Monitoring in North Brooklyn

NORTH BROOKLYN NEIGHBORS

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The author would like to thank Anthony Buissereth for extensive efforts designing the project, coordinating with community members, and collecting data. Thank you also to Lisa Bloodgood and Alan Minor for their leadership during the course of the project writeup and to Ramona Lall and Ryan Shanley for their input. The NYU Grossman School of Health team provided innumerable hours of help in the collection, analyzing, and writeup of this project; special thanks to Dr. Judith Zelikoff, Amna Raja, Christina Awada, Antonio Saporito, Tri Huynh, and Jania Zenon.

This report was made possible by the generous support from the New York Department of Environmental Conservation.

Introduction:

Air quality in North Brooklyn is a perpetual concern with the many sources of air pollutants in the neighborhood. Major sources of air pollution include traffic, and in particular the Brooklyn-Queens Expressway which cuts through the heart of the neighborhood, demolition and construction debris, and a large number of industrial facilities. The presence of these industrial facilities is an important characteristic of North Brooklyn: it is a neighborhood where people can both live and work.

However, the continued presence of industrial facilities and growing population in our neighborhood have meant that increasingly, the residential and the commercial/industrial areas are butting up against one another. Neighborhood residents have reported seeing and smelling fumes in multiple locations and are concerned about their health and safety.

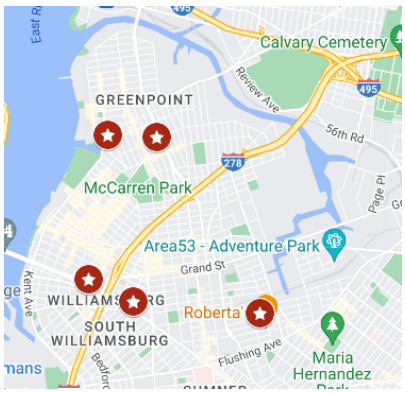
In response, North Brooklyn Neighbors, in collaboration with New York University Grossman School of Health, undertook a project to sample and analyze the air of five key sites located in our neighborhood. The results were concerning but not conclusive. Additional and more extensive monitoring is necessary to provide a more comprehensive understanding of air pollution hazards.

Every single air sample had levels of some type of volatile organic compound (VOCs), most frequently benzene, that were above the annual concentration as outlined in the New York State Annual Guideline Concentrations (NYS AGC). This is in line with Environmental Protection Agency (EP) estimate that 49% of New York City residents, as opposed to only 5% of the nationwide population[1], live in areas where levels of exposure to hazardous air pollutants— of which benzene is included— increase the cancer risk[2].

Additionally, the majority of samples had levels of fine particulate matter that exceeded the EPA's annual standard. This is also in line with other findings: according to the NYC Environment and Health Data Portal both the neighborhoods of Greenpoint and Williamsburg/Bushwick have fine particle level concentrations that are worse than the average. In fact, Greenpoint has the fifth highest concentration of fine particulate matter of NYC neighborhoods and Williamsburg/Bushwick has the seventh highest levels - and the city attributes the industry as a major contributor to air quality. In the Williamsburg/Bushwick neighborhood, these levels correspond to emergency department visits due to asthma for both children and adults that are some of the worst in the city[3].

Methodology:

Using input from the community, testing was undertaken during a 13-month window from November of 2020 through December of 2021. Testing targeted specific locations within the neighborhood that residents identified as concerning (see image right). More locations were suggested than we had the ability to sample, so locations were chosen that spatially represented multiple areas in the neighborhood so as to provide benefits and information to as many people as possible.



[1] https://ehjournal.biomedcentral.com/articles/10.1186/1476-069X-11-51
[2] https://www1.nyc.gov/assets/doh/downloads/pdf/eode/air-survey-spring11.pdf
[3] https://a816-dohbesp.nyc.gov/IndicatorPublic/beta/neighborhood-reports/

NBN partnered with NYU Langone to carry out the sampling. Sampling was done in conjunction with a community member or local organization, oftentimes in their yard or out of their window. Community members were taught basic skills which would allow them to participate in the collection and would allow the NBN and NYU investigators to leave during the collection process. Approximately 24 hours after the collection began, an investigator would return to collect the devices.

Collection methods included Summa canisters running for 6 hours for detection of VOCs. Vacuum air pumps were used in conjunction with PUF cartridges running for 24 hours for collection of polycyclic aromatic hydrocarbons (PAHs). Particulate matter smaller than 2.5 microns ($PM_{2.5}$) was collected on Teflon Filters with vacuum air pumps running at 10 L/min for 6 hours. Total $PM_{2.5}$ was collected at each sampling event, and further analysis of the particulate matter was done at least once at each site.

We tried our best to ensure that we would be getting results that were indicative of what chemicals were in the air when the facility was operational. During sampling, we noted smells in the air that seemed to be emanating from the facility in question, though these were sometimes stronger than at other times.

Lab Analysis:

All samples were sent to Con-test Analytical Laboratory (now Pace Analytical) in East Longmeadow, Massachusetts.

All Summa canisters samples were analyzed with the EPA TO-15 method for the following: Acetone, Benzene, 1,3 Butadiene, 2-Butanone (MEK), Carbon disulfide, Carbon tetrachloride, Chloroform, Chloromethane, Cyclohexane, Dichlorobenzene, Dichlorodifluoromethane, 1.2 Di-chloroethane, Ethanol, Ethyl acetate, Ethylbenzene, 4-Ethyltoluene, Heptane, Isopropanol, Methylene Chloride, 4-Methyl-2-pentanone, Propene, Styrene, Tetrachloroethylene, Toluene, Trichloroethylene, Trichlorofluoromethane, 1,2,4-Trimethylbenzene, 1,3,5-Trimethylbenzene, m&p-Xylene, and o-Xylene.

All PUF cartridges were analyzed with the EPA-TO13A method for the following: Acenaphthene, Acenaphthylene, Anthracene, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(e)pyrene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenz(a,h)anthracene, Fluoranthene, Fluorene, Indeno(1,2,3-cd)pyrene, 1-Methylnaphthalene, 2-Methylnaphthalene, Naphthalene, Perylene, Phenanthrene, and Pyrene.

Particulate matter was analyzed through gravimetric analysis to obtain the $PM_{2.5}$ concentration in each sampling site. This was followed by X-ray fluorescence (XRF) analysis for quantification of sodium, magnesium, aluminum, silicon, phosphorus, sulfur, chlorine, potassium, calcium, titanium, chromium, manganese, iron, nickel, copper, zinc, arsenic, strontium, praseodymium, erbium, cesium, and lutetium.

Major Findings:

A full list of results is available in the appendix. The results were compared against New York State's Annual Guideline Concentrations (NYS AGC). As a result, if the measured environmental concentrations exceed the NYS AGC, they may be hazardous to human health.

It is important to note that while presumably based in science, exposure guidelines are also subject to politics. Just as it was once acceptable to smoke inside a restaurant, we now do not accept that as protective of human health. Frequently, when guidelines are updated, levels which were deemed safe become more conservative. Even the guidelines outlined here by New York State may be revised in the

future, so it is always best to err on the side of caution and compare results against the most stringent standards.

Below is a table which outlines the VOCs and PAHs that were found at levels above the NYS AGC.

Contaminant	% of samples exceeding NYSAGC	Selected short-term health effects	Selected long-term health effects	Likely sources
Benzene	100% (10/10)	dizziness, headache, irregular heartbeat	anemia, cancer, effects on the immune system	gasoline, cigarette smoke, the plastics and resin industries
Carbon Tetrachloride	90% (9/10)	liver and kidney damage	liver and kidney damage	industrial applications, building materials, cleaning products
Tetra-chloroethylene	20% (2/10)	irritation of the respiratory system and kidney effects, as well as neurological effects	cognitive impairment, liver and kidney damage, several types of cancer	dry-cleaning, metal degreasing
Tri-chloroethylene	20% (2/10)	effects on central nervous system	central nervous system with effects on behavior, vision, memory, and headache. some evidence that it affects the reproductive system	industrial production, metal degreasing
1,3 Butadiene	10% (1/10)	irritation to the eyes and respiratory system as well as neurological effects	cardiovascular disease and cancer	motor vehicle exhaust and can be found in the production of resins and plastics
Fluorene	10% (1/10)	irritation of the eyes and skin	unknown	incomplete combustion of fossil fuels

Naphthalene	10% (1/10)	affects red blood cells and can lead to anemia	the U.S. Department of Health and Human Services concluded that naphthalene is reasonably anticipated to be a human carcinogen	vehicle exhaust, cigarette smoke, mothballs

In addition to the VOCs and PAHs listed above, $PM_{2.5}$ concentrations were found in levels that exceeded the Environmental Protection Agency's annual standards in five of eight cases. $PM_{2.5}$ is a measure of fine particulate matter. The smaller the particle, the more likely they are to make their way deep into the lungs. Sources of particulate matter in urban environments most commonly include vehicle exhaust and the burning of fossil fuels. In the short term, particulate matter irritates the eyes and respiratory system. $PM_{2.5}$ is also associated with increased respiratory and cardiovascular issues, such as asthma, and long-term exposures are associated with increased mortality from lung cancer and heart disease.

Findings by Location:

Satmar Matzah Bakery
427 Broadway, Brooklyn NY 11211
3 sampling events

Neighbors in the area have been concerned for a number of years over the emissions coming from the Satmar Matzah Bakery. NBN had previously worked with a local resident to monitor particulate matter in the area, and there was some anecdotal evidence that $PM_{2.5}$ rose when residents noticed smells they believed were coming from the bakery operations. As it produces matzah for the Passover season, there was some effort to ensure our testing was done during a time it was operating. The first two samples were taken approximately 12 hours apart during the month of November 2020, and the third sample was taken in March of 2021. Anecdotal evidence from the field reported a stronger smell during the third sampling event.

The Satmar Matzah Bakery is located in a potential environmental justice area as identified by the state of New York[4], and as an environmental justice area by the city. It is located in a census tract where 20.29% of the population live below the poverty level and 82.57% of the population are minorities.

VOCs: All three samples had levels of benzene and carbon tetrachloride that were above the New York State Annual Guideline concentration (NYS AGC). One of the three samples registered levels of 1,3 butadiene that were above the NYS AGC for and another was above the guidelines for tetrachloroethylene. Several other compounds were detected, but not at levels that exceeded the guidelines.

PAHs: One of the three sampling events found concerning levels of fluorene and naphthalene, both above the NYS AGC. Several other PAHs were found over the course of the sampling events, but not at levels that exceeded the guidelines. A full reporting of the concentrations can be found in the appendix.

[4] https://www.dec.ny.gov/public/911.html

$PM_{2.5}$: $PM_{2.5}$ exceeded the Environmental Protection Agency (EPA) annual standard one out of the three times and was measured at 23.89 ug/m3. The sample that exceeded EPA standard was sent for further analysis in order to identify and quantify the specific elements present in the particles. Lab results found that the majority of the particles were silica, which is often found at construction sites. Sodium was also found in high levels, likely from saltwater nearby. Calcium, magnesium, sulfur, iron, and zinc were also found in significant concentrations.

United Transit Mix
318 Boerum St, Brooklyn, NY 11206
1 sampling event

United Transit Mix is a supplier of ready-mix concrete. The facility is located a block from the Justice Gilbert Ramirez Park and parents at the nearby P.S. 147 expressed concern about the emissions from the site and the health and well-being of their children. The sample was taken out the window of a private apartment building next door to the facility in March of 2021.

United Transit Mix is located in a potential environmental justice area[5] as identified by the state of New York and by the city. It is located in a census tract where 29.98% of the population lives below the poverty level and 54.04% of the population are minorities.

VOCs: The sample returned results of elevated levels of benzene and tetrachloroethylene that exceeded the New York State Annual Guideline concentration. Several other compounds were found in the air, but not at levels that approached the guidelines.

PAHs: Some PAHs were found at levels detectable by our instrument, but none that exceeded the NYS AGC.

$PM_{2.5}$: Total $PM_{2.5}$ levels were detected above the NYS AGC at 14.17 ug/m3. The sample was sent for analysis and lab results found that the largest concentration of particulates was composed of sodium, likely from nearby saltwater. Sulfur, magnesium, calcium, iron, zinc, potassium, aluminum, and cesium were also found in significant concentrations.

Entrance Ramp to the Brooklyn-Queens Expressway
Roebling and South 4th Streets
2 sampling events

El Puente, a partner organization in North Brooklyn, has been raising the alarm about air quality in the southside of Williamsburg for years. One particular area of focus is the entrance ramp to the Brooklyn-Queens Expressway located outside their doors and bisecting a public plaza and a playground. Both samples were taken in June of 2021.

[5] https://www.dec.ny.gov/public/911.html

The entrance ramp is located in a potential environmental justice area[6] as identified by the state of New York and by the city. It is located in a census tract where 29.67% of the population lives below the poverty level and 63.48% of the population are minorities.

VOCs: Both samples found elevated levels of benzene and carbon tetrachloride that exceeded the NYS AGC guidelines. One of the samples returned results of 1.2-dichloroethane that were above the NYS AGC. Several other compounds were found in the air, but not at levels that approached the guidelines.

PAHs: One of the two sampling events found PAHs at levels detectable by our instrument, but none exceeded the NYS AGC.

***$PM_{2.5}$*:** Two days apart, the samples taken by the Williamsburg Bridge were steady at 15.83 ug/m3, a number that is above the annual EPA standard. The sample was sent for analysis and lab results found that the largest concentration of particulates was composed of sodium, likely from nearby saltwater. Calcium, silica, magnesium, sulfur, and iron were also found in significant concentrations.

Scheel Corporation
28 Franklin Street, Brooklyn, NY 11222
3 sampling events

Scheel Corporation supplies natural resins and waxes to the coatings industry. From their website, "Today we are also noted for our expertise in the hot melt blending of waxes and polyethylene`s for the ink, coating, and polishing industries." Two samples were taken from the yard of a private home in September 2020 about a block away from the site under investigation, and the third was taken in conjunction with an artist-run performance venue operating as a non-profit in December 2021.

VOCs: All three samples had levels of benzene and carbon tetrachloride that were above the New York State Annual Guideline concentration. One sample of the three came back above the NYS AGC for 1.2 di-chloroethane and another for trichloroethylene. Several other compounds were found in the air, but not at levels that exceeded the NYS AGC.

PAHs: No PAHs were found at levels detectable by our instrument.

***$PM_{2.5}$*:** Fine particulate matter was only tested and collected in December of 2021. Total $PM_{2.5}$ was above the NYS AGC at 24.05 ug/m3. The sample was sent for analysis and lab results found that the largest concentration of particulates was composed of sodium, likely from nearby saltwater. Sulfur, magnesium, calcium, iron, silica, zinc, potassium, and aluminum were also found in significant concentrations.

McGuinness Boulevard
at P.S. 34, 131 Norman Avenue Brooklyn, NY 11222
1 sampling event

[6] https://www.dec.ny.gov/public/911.html

McGuinness Boulevard is a busy road and truck route connecting two major highways that runs through the heart of Greenpoint. McGuinness Boulevard turns into the Polaski bridge as it continues from Brooklyn into Queens. Neighborhood activism, including the “Make McGuinness Safe” campaign and tragedy combined to convince the city that a redesign of the boulevard is necessary. But safety means more than just physical safety, and NBN felt it important to assess the air quality of McGuiness at a place of particular vulnerability, the elementary school whose outdoor play space is directly adjacent to the boulevard. The school serves around 400 students from pre-K through fifth grade including a special education program. Samples were taken from an outdoor stairwell on the grounds of the school in November of 2021 during the school day.

VOCs: The sample contained levels of benzene, carbon tetrachloride, and trichloroethylene that were above the New York State Annual Guideline concentration. Several other compounds were found in the air, but not at levels that exceeded the guidelines.

PAHs: No PAHs were found at levels detectable by our instrument.

$PM_{2.5}$: Fine particulate matter levels were below both the annual and 24-hour EPA standards. Further analysis of the particulate matter showed that the greatest concentration was sodium. Silicon, calcium, magnesium, sulfur and iron were also found in significant concentrations.

Recommendations:

We hope that this report highlights the need for air pollution monitoring in North Brooklyn. Some key takeaways from investigation into air pollution in include:

- Regular air pollution monitoring needs to expand beyond particulate matter. Our in-depth analysis found concentrations of several pollutants that were concerning and would not be picked up by particulate matter monitoring.
- Current policies focus on sources of air pollution at one facility at a time. However, exposure to contaminants does not occur in this manner. For example, a person whose home is located in between three industrial facilities needs to know that not that each individual facility meets standards, but that the air in their home which is impacted by all three facilities as well as the trucks on the street, is safe. The newly passed Cumulative Impacts bill (S.8830/A.2103D) ensures that all the facilities in a location are considered when considering environmental permitting in the state of New York. Proper enforcement of this law will do much to ensure that air pollution levels are reduced in our neighborhood.
- With industrial facilities located in close proximity to residences, there needs to be increased transparency as to which measures are in place to ensure that emissions from facilities are at safe levels. If information about permits, contaminants emitted, and inspection protocols are accessible to the public, this would go a long way towards reassuring those members of the public that they are not being overlooked, even when smells are noticeable.
- Reports made to the city, when investigated, are often done so at a later day and time. As many facilities operate only at certain times, or do different processes during their operations, it is very likely that any monitoring that is done at a later date may not catch the facility operating in the same way as when the concern was raised. Therefore, it is imperative that the follow-up testing times should be done at a time when the facility is likely to be running. In this, local residents can be an invaluable resource. They often know, for example, the smells tend to be strongest in the

mornings. This information should be collected and then influence when follow-up investigations are done.

- While it is true that our samples were done near the facilities named, that does not necessarily mean that any contaminants that were detected come from the facility. However, this should not be an excuse for inaction. Instead, it should be a call to action. If the contaminant is not coming from the facility, then it is even more concerning that these levels are in our ambient air.

Conclusions:

In general, levels of air contaminants are higher than desired for public safety. Benzene was found in levels above guidelines in all ten samples, and carbon tetrachloride was found in nine of ten samples. While these are the two most ubiquitous findings, the presence of other contaminants, such as tetra-chloroethylene, trichloroethylene, 1,3 butadiene, fluorene, and naphthalene - all found at levels above that which the state deems as safe - is also cause for concern.

Our testing cannot positively identify that the contaminants found are attributable to the specific facilities that we tested near. This is especially true in areas such as North Brooklyn where there are a wide variety of activities present within a small area. Cars and trucks, construction, industrial facilities, and cigarette smoke, among other sources may all contribute to the results. However, our methods do show that in multiple locations over multiple time periods the levels of pollutants are not in compliance with New York State annual guidelines. This is very concerning.

Ultimately, it should not be up to local residents and community groups to identify potential concerns and determine whether local industrial facilities are generating unsafe levels of emissions. Instead, permitting of facilities should be contingent on proof that their levels of emissions, in conjunction with emissions nearby, do not raise levels anywhere in the neighborhood to those that are harmful to human health or the environment.

We hope that the information found in this report is used as a call to action to take seriously the air quality concerns in North Brooklyn and to provide resources and accountability to ensure that our local industries remain productive and valuable members of the community without endangering the health of nearby residents.