Clearing up the Haze
Towards a Comprehensive View of the National City Air Quality Picture

Spring 2014 – Graduate School of Public Health, San Diego State University
Paul Maechler, Environmental Health Division, GSPH
Data collected by graduate students at SDSU was presented to National City officials in Spring 2014.

Paul Maechler, Graduate School of Public Health
Zohir Chowdhury, Professor, Graduate School of Public Health
Jessica Barlow, Director of the Sage Project

Table of Contents

Executive Summary ................................................................................................. 4
About the Sage Project .......................................................................................... 4
About National City ............................................................................................... 5
Acknowledgments .................................................................................................. 5
Sage Project Directors and Staff .............................................................................. 5
Introduction .......................................................................................................... 6
Pollutants of Interest .............................................................................................. 6
Instrumentation ...................................................................................................... 7
Air Quality Studies ................................................................................................. 8
National City Public Library ...................................................................................... 8
Hotspots .................................................................................................................. 11
El Toyon Elementary School ................................................................................... 14
City Parks ............................................................................................................... 17
Project Summary ................................................................................................... 20
References ............................................................................................................. 22
Executive Summary

The data contained in this report were generated during collaboration between National City, the Sage project, and San Diego State University’s Graduate School of Public Health (GSPH) in the spring of 2014. Fourteen students from the Environmental Health division of the GSPH who were enrolled in a course entitled ‘Air Quality’, taught by Professor Zohir Chowdhury, designed and implemented studies pertinent to the hypothesized Air Quality issues which may arise in National City. Dr. Chowdhury guided and directed the implementation of the studies, and instructed on ways to optimize the study designs.

In total, four studies were conducted, with students choosing to focus on various spatial and temporal components of air pollution, as well as demographics of interest within the city. This included a fixed-site, continuous monitoring study, a ‘hot-spot’ or multiple site monitoring study, a study focused on exposure to school-aged children, and an occupational exposure study.

As part of the course, students were trained on relevant instrumentation, as well as relevant software and statistical measures to employ in the analysis of the collected data. Each study was summarized and written up in the style of a peer-reviewed journal publication, and the results of each study are summarized in this report. The conclusion offers some suggestions for possible remediation steps to limit residents’ exposure to pollutants, as well as ideas for the scope and direction of future research efforts in the city.

The scope of this project as a whole can be considered that of an exploratory pilot study. The data sampling was extensive, but by no means should it be considered an exhaustive or final summary of pollutant dynamics throughout the city. Rather, this project represents an important first step and primary assessment of the city’s pollutant levels. The data collected provide valuable baseline information to direct further studies which can in turn paint a more complete picture of the city’s air quality.

About the Sage Project

The Sage Project is a partnership between San Diego State University (SDSU) and a local government in the San Diego region. Students, through their course work, engage in meaningful real-world projects and contribute to the quality of life of residents in a community in SDSU’s service area. Students from across the University assist local governments with partner-directed projects that address their smart growth, quality of life, and sustainability goals. SDSU students and faculty connect with high-priority, high-need community projects, thereby generating interest and fresh ideas that create momentum and provide real service to the community.

The Sage Project is based on the highly successful and award winning Sustainable City Year Program at the University of Oregon. Like the project in Oregon, the Sage Project at SDSU engages hundreds of students who invest thousands of hours assisting communities in our region as they seek to build a more equitable and sustainable future.

About National City

National City is a highly urban community of about 60,000 residents in south San Diego County. It is the second oldest city in the county and boasts a rich history, a diverse community, and is known as one of the most walkable cities in San Diego County. Located just south of downtown San Diego and just north of the US-Mexico border, the city is flanked by freeways and is home to large-scale industries. National City is a mid-size city that faces big city challenges, and, like many municipalities, the city is challenged to meet community needs and new demands of sustainability. By providing new ideas and human capacity, this partnership with the Sage Project will help National City implement sustainability concepts and practices into projects that will improve livability.

Acknowledgments

We would like to thank Brad Raulston, Executive Director of Development for the City of National City, who spoke to our class about the City of National City. We also would like to thank those city staff members who attended the presentations and provided useful feedback to us regarding our ideas: Leslie Deese (City Manager), Stacey Stephenson (Administrative Services Director), and Frank Parra (Fire Chief). Thanks also to Geoff Chase, Dean of Undergraduate Studies at SDSU for his helpful feedback.

The author would like to thank all of the SDSU graduate students whose hard work in data collection made this summary possible, as well as all of the National City municipal employees who were always extremely friendly and helpful in facilitating the data collection.

The author would like to especially thank and acknowledge Dr. Zohir Chowdhury, whose guidance and feedback throughout this process has been paramount to its successful completion, and whose passion for teaching the subject was a source of academic inspiration for his students.

Sage Project Directors and Staff

Jessica Barlow, Program Director
Piper Whalen, Graphic Design Intern
Introduction

National City is in a relatively unique position from an Air Quality perspective. Its geographic location lends itself to potentially high exposure to anthropogenic air pollutants because virtually the entire city lies within a one mile radius of one of three (and in some cases more than one) major freeways in the region: Interstate highways 5 and 805, and California highway 94. In addition to freeway emissions, National City is in close proximity to a range of industrial activity. This includes port and maritime operations, as well as naval activity. These are all potential sources of black carbon (BC) and fine particulate matter (PM2.5), pollutants of interest to which residents ought to limit their exposure, when possible. While there are other locations in San Diego County which are in comparable proximity to these freeways, National City is unique in that there are no Cal-EPA air monitoring sites located within the city limits.

There are air monitoring stations in the neighboring cities of Chula Vista and San Diego, but these cannot necessarily be used as a proxy measurement for air quality in National City as air pollution concentrations have been shown to exhibit high spatial variability (Eeftens et. Al 2012). In light of the fact that there is no current air monitoring within city limits, and given that the city’s location lends itself to potentially high exposure to PM2.5 and BC, there is a need for exploratory research into the levels to which residents and municipal workers may be exposed. This information may be helpful in assessing exposure to municipal workers and the public alike, which may in turn assist city officials in implementing effective, targeted remediation steps.

The primary goal of this pilot project was to begin to understand the spatial distribution of air pollution in National City. The ultimate goal of deriving this information is to identify which groups of residents may be more at risk of exposure to these pollutants, as well as provide all residents and officials with information about ways to minimize this exposure. The studies conducted within this project were designed with this ultimate goal in mind, with each aimed at addressing particular regions and/or groups within the city. Because source control in this case (i.e. reduction of freeway emissions) is largely beyond the city’s capacity and jurisdiction, the remediation steps would likely focus on exposure reduction, which was also a consideration in designing the studies. The details, implications, and limitations of each study, as well as those of the pilot project as a whole, are discussed here.

Pollutants of Interest

Lack of pollutant-monitoring data in National City can be problematic from a public health standpoint. Freeway emissions have been exhaustively linked to increased risk of asthma, lung cancer, and cardiopulmonary-related mortality (Laden, 2000; Harrison & Yin, 2000). This is presumably related to the fact that certain pollutants such as fine particulate matter, also referred to as PM2.5 (meaning particulate matter that is less than 2.5 micrometers in aerodynamic diameter), is found in higher concentrations near major freeways. PM2.5 is of particular concern because it is small enough in diameter that it is not as effectively removed by the lungs’ natural defense mechanisms and can be deposited deep in lung tissue and/or absorbed into the bloodstream (EPA, 2014).

Black carbon (BC), a byproduct of incomplete combustion of fossil fuels and often used as a marker of diesel-based fuel pollution, can comprise a significant portion of the PM2.5 associated with major freeway pollution (Janssen et. Al 2012). BC has in its own right been linked to increased risk of cardiovascular and respiratory diseases (Janssen et. Al 2012). Those that live within 150 meters (approx. 450 ft.) of a major freeway may be at particular risk, as it is within this range that exposure has been found to be significantly higher (CDC, 2014).

Instrumentation

In order to measure the pollutants of interest, monitoring instruments from the Graduate School of Public Health, San Diego State University, were used: Dustrak, Microaetholometer, HOBO, and Minivol. The Dustrak measures PM2.5 by sampling ambient air through an intake tube and measuring the scattering of light as it passes through a measurement chamber inside of the instrument. By measuring amount of light scattering, the instrument can detect PM2.5 concentrations in the sample. Because this is an indirect measurement of particulate matter, the data is corrected against Minivol data (discussed in next section).

The Minivol utilizes a cyclone filtration system in which incoming ambient air is sent down a cyclone-shaped filter and exposed to velocities such that any particles with an aerodynamic diameter larger than 2.5 micrometers are cast to the side. This ensures that only particles with an aerodynamic diameter less than 2.5 micrometers (PM2.5) are collected on a filter below the cyclone. This filter is weighed before and after sampling to determine the mass of PM2.5 that was collected during the sampling period. This mass is then divided by the total volume of air sampled to obtain an average PM2.5 density for a given period of time. Because this device measures the actual mass of PM2.5, it can be considered a direct measurement and is thus used as the ‘gold standard’ against which the Dustrak PM2.5 measurements are corrected.

The Microaetholometer measures BC by passing air through a sampling chamber which is then exposed to a light source. Due to their color, BC particles absorb light very well and thus amount of light absorption is measured as a proxy for BC concentration. The HOBO device is capable of giving continuous temperature and relative humidity data, which can be very useful in very humid conditions. In such conditions, particulate matter can remain in the air for exceptionally long periods of time, and can also be denser than normal, leading to overestimations of concentration by the Dustrak. By measuring relative humidity with the HOBO, it is possible to apply a correction factor (Chakrabarti et. Al 2009) as another quality assurance step to ensure accurate measurement of PM2.5.
Air Quality Studies

National City Public Library
Christer Baluyot, Brian Legendre, Marcella Oei

Background

In order to obtain a useful relative scale of more or less polluted areas and times of day within the city, it is important to obtain background pollutant levels. In an ideal scenario, fixed site monitoring would be implemented at each of the regions sampled, as well as multiple “hot spots” or points of interest throughout the city. An ideal location for background monitoring is one with minimal impact from pollutant sources and a central city location. In order to fit these criteria, National City Public Library was selected as the site for the fixed air quality monitoring station. The library was also selected due to its relatively equidistant location from the I-5 and I-805 freeways, as well as the relative security of the rooftop location (a necessity due to the fact that the instruments were recording data 24/7 and had to be left alone at times).

Seven-day monitoring

Over a period of seven days (March 17-23, 2014), pollutant concentration data was collected continuously (24/7) using a Minivol and Dustrak for PM2.5, and a Microaethometer for BC. A HOBO for measuring temperature and relative humidity was also used. A correction factor derived from this Minivol data was used for all data collected using the Dustrak throughout the project.

Results indicated that PM2.5 levels were significantly higher on March 19-20 than on other sampling days. These results actually coincided with data from the San Diego County Air Pollution Control District’s (SDAPCD) air monitoring stations in downtown San Diego (www.sdapcd.com, 2014). The cause of these increases was unknown, but believed to be likely related to a point-source emission since review of the local weather patterns indicated that conditions were not abnormal relative to normal seasonal patterns. The data also showed that there was much greater variability throughout the day in PM2.5 and BC levels on weekdays versus weekends, further implicating freeway traffic patterns (fluctuations due to rush hour) as a major influence on pollutant levels.

Because hourly PM2.5 levels are available for downtown San Diego, it is worth comparing hourly PM2.5 measurements from that station with the results from this study. For each of the seven sampling days, hour-by-hour comparisons, as well as mean daily PM2.5 levels, were compared between the two datasets. It was found that on 4 of the 7 sampling days, mean PM2.5 levels were statistically significantly lower at NCPL than the downtown San Diego air monitoring station. On the other three days, there was no significant difference in PM2.5 levels, although there were often noticeable fluctuations between the two datasets on an hour-by-hour basis (see figure below). It is worth noting that comparisons between these two sites is far from perfect; NCPL was chosen because it was suspected to have some of the lowest pollutant levels in National City, while the monitoring station in downtown San Diego sits right beside Lindbergh field and I-5, so it is likely to record some of the highest PM2.5 levels in all of the city. In other words, this data should not be interpreted as suggesting that the air quality throughout National City is wholly better than that of the city of San Diego, but rather the air quality at NCPL is likely better than that of the downtown San Diego monitoring station.

The Minivol data collected here was of particular importance to the project as a whole because its data allowed for a correction of the Dustrak data. Another important component of this monitoring event is that it was measuring pollutant levels continuously and, unlike the other studies conducted in the project, captured time points in the late evening and early morning hours (and also allowed for comparison to the City of San Diego’s fixed site monitoring data). Because the library is its own unique location, the data presented here is not necessarily representative of all locations throughout the city.

Figure 1: Fixed Site Monitoring
However, it is quite possible that the same relative pollution dynamics (higher relative levels during rush hour) are occurring throughout the day all over the city, even if the absolute measurements of pollutant concentration vary across locations. Still, further 24-hour sampling in other locations with closer proximity to a major freeway would be needed to confirm this.

The finding that variability in pollutant levels is greatest on the weekdays is significant for informing the public of times to limit exposure to areas near the freeway, and likely warrants further investigation at perhaps a location which is within closer proximity to one of the two major freeways. Lastly, since some of the data coincided with data collected in downtown San Diego by SDCAPD, it may be worth investigating this relationship for all data collected within National City limits. It would indeed be useful if pollution levels in downtown San Diego measured by the SDCAPD were found to reliably correlate with those found in National City.

**Hotspots**

Sero Kassabian, Matin Nazari, Anh Nguyen

**Background**

One of the more critical first steps towards identifying the locations within the city with the best air quality is identifying the locations with the worst. If a majority of locations cannot be sampled due to resource limitations, sampling the locations suspected to have the highest pollutant concentration can be a valuable starting point for informing residents about locations and times within those locations to limit exposure.

**BC and PM2.5 hot spot monitoring**

Five locations around the city were selected based on proximity to freeways and/or major industry, beginning east and moving toward the coast with respect to sampling locations to establish any possible trends in air quality as a function of coastal proximity. With these criteria in mind, El Toyon Park, the corner of Palm and 5th Ave., the Wal-Mart parking lot, a location directly across the street from A-1 recycling center, and Pepper Park were all sampled. The sampling took place over the course of three consecutive days (March 16-18, 2014) from approximately 12:30-5:00 pm. The goal was to capture locations east and west of the two major freeways as well as to sample areas in close proximity to industrial activity.
Findings from the PM2.5 data (shown in figure 5) are varied in an interesting way. On the first monitoring day (3/17/14), Pepper Park exhibited statistically significantly higher levels than all other locations. Conversely, on the second and third days (3/18/14 and 3/19/14), El Toyon exhibited statistically significantly higher levels than all other locations. Given that El Toyon Park has been found to have relatively high PM2.5 levels in other studies within this project, the 3/17/14 data may be somewhat anomalous. That levels at El Toyon were lowest of all five locations on this date, and levels at Pepper Park were the highest, implies one of two likely explanations: the prevailing wind direction was offshore (flowing east to west) on 3/17/14, and thus all freeway pollutants were carried towards the coast, or there was increased industrial (i.e. port) activity near the coast on this day. However, PM2.5 levels were significantly lower at El Toyon Park on 3/17 compared with El Toyon Park on both 3/18 and 3/19 (data not shown in figure). This implies that it was indeed prevailing wind direction, rather than coastal industrial activity, that was the main factor in the finding of elevated levels west of the major freeways on 3/17 since freeway pollution from the 805 was not apparently reaching El Toyon Park. These findings highlight the importance of monitoring weather conditions in order to capture changes in air quality dynamics day-by-day.

For BC, the average highest concentrations were found at El Toyon Park. Excluding El Toyon Park, the lowest BC levels were measured at Palm Ave and E 5th St (just west of I-805), with levels increasing slightly as locations moved westward to the coast (although the increase was not statistically significant). These findings are mostly in line with the pattern exhibited by PM2.5 levels at each of the five locations, a finding which reinforces the notion that one of the main contributors of PM2.5 levels throughout the city is freeway traffic.

Limitations to the study include the relatively low sampling frequency for each site because each site was sampled for approximately 25 minutes for each sampling day. This means that there was a low amount of data points collected, which is an issue particularly when the data show high variability. Still, this study was able to collect data from numerous locations with distinctly different locations relative to the major freeways, and there were found to be locations which exhibited statistically significant differences in pollutant levels on given days. This is advantageous when considering the effect of both wind and freeway proximity on exposure to residents.
El Toyon Elementary School
Emily Bryson, Claire O’Brien, Valerie Root, Lauren Wakham

Background
Populations within a community which are at particularly high risk of air pollution-related health effects should be identified and accounted for in a study aimed at informing the public on health risks. To address one such population in National City, BC concentrations were measured near El Toyon Elementary School (ETES), a primary school whose student body is comprised of children aged 5-12. This population is extremely sensitive to airborne contaminants due to their immature respiratory systems (WHO, 2014). In addition, children are likely to get a higher exposure given that they have a higher respiratory rate compared to adults and thus inhale more airborne pollutants per unit body weight than other members of the population (Mott, 1997). Elementary school children may as such be considered a sensitive population that warrants special consideration with respect to exposure reduction steps.

BC Monitoring Near El Toyon Elementary School
Due to ease of access, BC measurements were taken using a Microaethalometer at El Toyon Park (which lies adjacent to the elementary school) during normal hours of operation of the school. Samples were collected during three days in which class was in session: Tuesday, March 25th, Wednesday, April 2nd, and Tuesday, April 8th, respectively. A fourth sample was also collected on Saturday, March 29th to compare weekdays with weekend days. Samples were collected twice per day, between 8:30-9:30 am and 11:15am-12:15 pm (lunch periods).

Mean BC levels were found to be significantly higher on March 25th and April 8th than on April 2nd. This may be attributed to the fact that there was a rain event the night of April 1st (which is generally associated with lower BC concentrations in the hours which immediately follow). Additionally, significant differences in mean BC concentration were found between early morning periods (8:30-9:30 am) and lunch time periods (11:15am-12:15pm), but it was not constant across days (i.e. some days the early morning periods were higher than lunch periods, and other days vice-versa). This variation was attributed to possible fluctuations in traffic and industrial activity during these periods on these days. Additionally, no significant difference in mean BC concentrations was found between weekend and weekdays. It is important to note that on all sampling days the BC levels did not regularly exceed levels of 1 ug/m³, which is well below levels considered ‘high’ in other studies involving BC (Buonanno et al. 2013, Dons et al. 2012).

Comparison of mean black carbon concentrations across four sampling days, as well as comparison of mean between weekdays and weekend days. Levels on 4/2 were found to be significantly lower than the other three days, and no significant difference was found between weekend and weekday levels.

Figure 7: Daily BC Concentration
As with all of the studies conducted for the project, time and resource constraints meant that a relatively small sample size was collected. It may be the case that there are identifiable patterns with respect to morning and afternoon BC concentrations, as well as weekday vs. weekend conditions, but these are difficult to tease apart without more exhaustive sample collection. Still, there are precautionary remediation steps which may be considered in order to limit the exposure of children at ETES to BC, including the installment of trees around the school grounds which can adsorb and reduce BC particle concentrations (Nowak, 2000). Additionally, the chances of outdoor air quality negatively impacting indoor air quality can be reduced by regular air filter and duct cleaning (Beko, 2009).

Overall, the results of this study indicate that there is not an obvious remediation step with respect to modification of bell schedule etc. to limit ETES students’ exposure to BC. Nonetheless, susceptible populations such as young children must be considered when assessing health impacts of air pollution. With more sampling and mapping of the general tendencies of air pollution near the school, it may be possible to establish a preferred walking/transportation route to school for children, as well as a bell schedule which can minimize exposure of harmful pollutants to school children.

City Parks
Amanda Gee, Paul Maechler, Rebecca Watkins, Lenard Yabes

Background
When attempting to inform the public on the cleanest, safest city locations from an air pollution standpoint, there are many factors to consider due to the day by day, hour by hour, and even minute by minute changes that can occur as a function of various activities throughout the city. City maintenance, in particular that which utilizes gas-powered machinery, is one such factor which can affect the levels of particulate matter that residents are exposed to at a given location at a given time. Furthermore, city workers operating gas-powered machinery may be at increased risk of chronic exposure if the proper protective equipment is not used. Many small gas-powered machines, such as leaf blowers and lawn mowers, use 2-stroke engines which emit considerably more PM2.5 and BC than their 4-stroke counterparts (the engines used in larger motor vehicles). Pollutant increase associated with the use of this equipment is therefore a pertinent event to consider when assessing the overall air quality of a given location.

City Park Monitoring
In order to measure changes in particulate matter that occur as a function of maintenance machinery operation, PM1 (particulate matter with aerodynamic diameter less than 1 ug) PM2.5 was measured before, during, and after leaf blower usage in three National City parks. Monitoring equipment was set up before routine leaf-blower usage at El Toyon, Kimball, and Las Palmas parks. These were selected because they are major parks within the city in which residents may be more physically active than other parts of the city and thus inhaling a larger quantity of air. Temperature and relative humidity were also collected during these times, and the monitoring device itself was set up at a fixed location during the leaf blowing event to simulate a stationary park patron’s exposure. Both PM1 and PM2.5 were found to be significantly higher when the leaf blowing machine was in close proximity to the monitoring device.

In addition, the background PM2.5 measurements (those taken before the onset of leaf blower usage) provided information about relative levels of background pollutants at each of the three parks. Of the three parks, El Toyon was found to have significantly higher levels of PM2.5 than both Kimball and Las Palmas parks. This data alone provide useful information to residents as to which park locations may be the cleanest from an air quality perspective.
A consideration for future studies of this nature may be to collect GPS data along with observational data about the occupational usage of park maintenance machinery. This is a relatively affordable and accessible technology which can serve to further reinforce (and precisely map) the spatial relationship between PM2.5 and usage of 2-stroke engines.

This study provides useful data about the relative spikes in particulate matter concentrations during the usage of park maintenance machinery. This information can be used to advise residents and city park employees about the potential hazards of being in the close proximity of these machines while in operation. For residents, this does not at all prevent the usage of parks during times of operation of maintenance equipment, but rather avoidance of close proximity to the machines during operation, particularly for residents who may be more susceptible to effects from increased PM exposure (i.e. asthmatics and those with pre-existing respiratory conditions). For employees, the use of masks while operating these machines may also be advised.

![Particulate matter concentrations at 3 different National City park locations. PM spikes were associated with leaf-blower usage. PM2.5 concentrations were adjusted against gravimetric PM measurements and relative humidity to control for instrument limitations. EPA NAAQS standards for daily average PM2.5 concentration are indicated by the dotted yellow line on each graph.](image1.png)

Figure 9: Particulate Matter Levels Leaf Blower Usage

![Mean PM2.5 levels at three National City park locations. Levels at El Toyon Park were found to be significantly higher than at both Las Palmas and Kimball Parks (error bars represent 95% confidence interval for mean).](image2.png)

Figure 10: Mean PM2.5 Parks
Project Summary

With no regular air quality monitoring data recorded in National City, the residents and city officials are at a disadvantage with respect to identifying regions and/or conditions in which excess air pollutants are discharged. This in turn makes it difficult to perform targeted remediation steps aimed at improving public health and overall air quality in the city. The goal of this pilot project was to, within the resource and time constraints at hand, collect air pollution data that could help to inform and guide both current and future public health efforts within the city.

Since the ultimate goal is to at least limit exposure to city residents, future air quality research efforts should be aimed at obtaining data which can provide general exposure-reduction strategies. The first feasible step towards this is to simply reduce citizens’ outdoor activities in areas and during times of day of high pollutant levels (rush hour). Additional sampling in the regions such as El Toyon Park is one way to further characterize the pollutant dynamics in regions with relatively high pollutant levels. Further, capturing pollutant levels during the various weather conditions which occur regularly or seasonally (onshore versus offshore wind direction, speed, etc.) to identify how the most polluted areas may change relative to the changes in these conditions would be another crucial step towards a complete pollution ‘map’ of the city. Additionally, more fixed site (24-hour) monitoring at other city locations could be very useful in capturing the temporal dynamics of pollution toward a general model of what times of day residents should limit exposure.

The second feasible exposure-reduction strategy would be to adhere to best management practices (BMPs) with respect to the landscaping around the city. It may be prudent to develop an ideal list of landscaping flora which can help to better adsorb particulate matter and black carbon in particularly sensitive areas of the city (ideally ones which still maintain similar aesthetic and maintenance qualities to those already planted throughout the city). This list may be obtained from previous research (Maher et. al 2013; Vos, Malheu, VankerKom, & Janssen, 2013), or it could be tested by the city or the city’s future collaborators. This would involve sampling pollutant levels in the vicinity of both a known pollution source and the various candidate flora in order to determine which are most effective at adsorbing and effectively removing (from a human exposure standpoint) these pollutants from the air.

The studies combined to sample multiple regions (see figure below) within the city on multiple days, but much more sampling is warranted to better characterize spatial and temporal pollutant distribution, given the dynamic nature of air pollution (i.e. fluctuations in levels due to wind direction, storm events, and industrial activity, to name a few). While there are facets to the air pollution ‘story’ of National City that the project has made relatively clear (e.g. excessive pollutant levels occurring in the El Toyon Park area), the primary strength and value of this pilot project is in identifying regions and/or demographics within the city whose characteristics warrant further study. In short, there was a significant amount of sampling conducted for this project which can provide valuable guidance to future research, but it is nevertheless a baseline exploratory study.

Given the ever-present constraints of time and resources, the ability to collect data from projects such as Sage are paramount to forwarding the understanding of the pollution dynamics (and ultimate remediation steps) in National City. Collaboration with neighboring municipalities (Chula Vista, San Diego) which regularly collect air quality data may also prove useful. This can come in the form of partnered municipal studies, continued synergistic efforts with academic institutions, or simple data-sharing. With continued research and collaboration, the understanding of the dynamics of National City’s air quality will improve, and the picture (ultimately the air) will hopefully become clearer.
References


