



# Introduction

Oakland is a metropolitan city in the San Francisco Bay Area. Traffic from diesel trucks carrying packages and many cars with people traveling through the area causes air pollution. Air pollution is the mixture of gases and solids that can cause harm to humans. Some examples of air pollution are carbon monoxide, sulfur oxides and ozone precursors. Particulate matter is solid material that escapes from combustion processes and can be inhaled, causing potential health problems. Smaller particulate matter sizes are more dangerous since they can enter your bloodstream and penetrate deep into your lungs. Particulate matter can cause health issues such as: asthma, cardiovascular disease, & bronchitis. Research shows that low income people and people of color are more likely to live in high pollution areas than others. Within Alameda County there are more African Americans and Latinos living close to the freeway (500ft) than further away (greater than 500 ft.) African American children are 2.5 times more likely to go to the emergency department for asthma related issues compared to all children in Alameda County (Alameda County Public Health Department, 2008)

We are a group of 8<sup>th</sup> grade students from various middle schools who are studying air pollution and how diesel fuel burning trucks affect our community. We decided to compare the impact associated with the 580 and 880 freeways, two major freeways in Oakland. Our research investigates which freeway generates more air pollution. We hypothesized that the 880 freeway would generate more particulate matter because of the diesel fuel burning traffic or trucks that travel along this freeway, as opposed to the 580, where such traffic is not permitted.

# Methods

First, we selected our locations based on our distance between the 580 and 880 freeways. We walked to the 880 freeway locations (listed below) and then we took the bus to the 580 freeway locations (listed below). At each site we used the fluke particle counter (counts particles based on size), a GPS receiver to determine our geographical coordinates, an anemometer to measure wind speed, and camera to record pictures of our sample locations). Samples were collected in the same order at the chosen locations over 4 weekdays in the summer and 2 Saturdays in the fall (dates listed below). 880 freeway data was collected on 07/15/10 (Th), 07/19/10 (M) and 09/18/10 (Sa). 580 freeway data was collected on 07/20/10 (Tu), 07/21/10 (Wed) and 10/02/10 (Sa). The times we collected the data in the summer was at 9:30a.m. and in the fall it was at 11:00 a.m.

### 880 Freeway Sample Locations:

- E. 12th and Fruitvale Ave.
- E. 9th and Fruitvale Ave. (closest to freeway)
- E. 9th and 37th St. (closest to freeway)
- E. 12th and 37th St.

580 Freeway Sample Locations: Quigley St. and 35th Ave. (closest to freeway) 580 and 38th Ave. (closest to freeway) MacArthur Blvd. and 38th Ave. MacArthur Blvd. and 35th Ave.



Figure 1 (left above): Street signs of sample location. Figure 2 (left below): Photo of sample location overlooking the 580 Freeway. Figure 3 (right): Map of particulate matter location samples near the 880 and 580, Oakland, California

# **Comparing Particulate Matter Pollution on the 880 and 580 Freeways**

Bianca Centeno, Camron Girton, Chasiti Crockett, Dagmawi Fasil, Damaris Romero, Daniella Ruiz-Arroyo, Devondre Spears, Jacob Adams, Kamuri Williams, Lindsay Tate, Manaiya Scott, Micah Burris, Philmon Lei, Raul Ramirez, Karren Gilliland, Andrea González Negrete Lawrence Hall of Science, University of California, Berkeley

### **Results and Graphs** 580 Freeway PM Size 0.3 80000 70000 60000 6000 **5**50000 **50000** 4000 30000 **E** 30000 20000 20000 10000 10000







- For particulate sizes 0.3, 0.5, 1.0, 2.0, and 5.0µm (micrometers) all locations had higher particulate counts on weekdays than on weekends.
- During the summer weekdays, the locations near the 880 freeway had a higher particulate count than the locations near the 580 freeway for particulate sizes 0.5, 1, and 2µm.
- During the summer weekdays, the location of E. 9th and 37th St. had the highest particulate counts for particulate sizes 0.5, 1.0, 2.0µm.
- During the fall weekends, the location of MacArthur Blvd. and 38th Ave. had the highest particulate counts for particulate sizes 0.3, 1.0, and  $2.0\mu m$ .
- During the fall weekends, the locations near 580 Freeway had a higher particulate count than the locations near the 880 Freeway for particulate sizes of 0.3, 0.5, 1 and 2µm.



Fall (Saturdays) Fruitvale Locations

After collecting and analyzing particulate matter data, we concluded that our original hypothesis was partially correct and partially incorrect. In the summer we found that for 0.5, 1, and 2µm., the highest points occurred along the 880 freeway. Along the 580 freeway we found that PM counts for 0.3 particle size were higher than those recorded along the 880 freeway. When we did further data collection on the weekends during the fall we saw that the summer weekday values were significantly higher than those associated with fall data collected on Saturdays for all PM sizes with the exception of PM sizes 5 and 10 µm. At all locations where we made measurements, the count was at least 70% lower for sizes 0.3, 0.5, I, and 2 when compared with our summer data. Since we know that burning fuels produces air pollution, we presume that values measured on weekdays were higher than those recorded on weekends due to higher traffic levels. This is supported by the fact that we observed 93 trucks pass by in a two-minute time period during a summer data collection day at 10:00 a.m. along the 880 freeway. Despite the fact that we thought air pollution would be the highest along the 880 due to the heavy volume of trucks burning diesel fuel, we discovered that the highest and lowest points are actually scattered between both freeways.

Throughout the investigation, our main hypothesis was that the 880 freeway would generate more particulate matter counts than the 580 freeway due to the presence of diesel fuel burning trucks. However, we observed that the 580 freeway generated more 0.3 and 10.0µm particulate matter (pm) counts. A possible reason for our results is our location choice and time. The area near the 880 freeway is residential and commercial. By the time we arrived at our location next to the 880 freeway, between 10:00-11:00am, most people may have already traveled through the area to get to their jobs. The 580 freeway area in which we made measurements was a small residential area behind the freeway. Some of our data location points along this freeway were high traffic areas like 35<sup>th</sup> Ave. and Mac Arthur Blvd. This intersection has multiple bus stops, 9 gas stations, and 9 fast food restaurants within a 1.1 mi. radius. Our results may have been influenced by the high amount of traffic and idling (keeping the engine on and not driving).

Temperature may have affected our results (http://www.epa.gov/apti/bces/). The fall season had an overall lower particulate matter count than in the summer. This could be because wind and rain help clean away air pollutants (http://www.epa.gov/apti/bces/). Monitoring the weather while collecting data could be a direction we move towards in further investigations.

### What can we do with this information? With this information, we can now start brainstorming solution. Some solutions include:

•Mechanical collectors. Two main types are large-diameter cyclones and small-diameter multi-cyclones. A large diameter cyclone is used for cleaning particulate matter in the air. It works by taking up particulate matter and cleaning it up, then releasing clean, purified air. The dirt can then be disposed of. A small-diameter multi-cyclone does the same thing except it can take up particulate matter 0.625 times smaller than a large cyclone. •Reduce exposure to diesel particulates by eliminating diesel trucks in residential neighborhoods and enforcing no-idling law near schools. •Engage communities in decision-making through meaningful public participation in land use planning and pollution mitigation decisions.

Rayos, Jeff and Lee, Anna. "Freedom to Breathe." Communities For A Better Environment. (September, 2009). Web. The Alameda County Public Health Department. "Life and Death From Unnatural Causes." Community Assessment, Planning, Education, and Evaluation Unit. (April, 2008). Web. Air Pollutants and Control Techniques – Particulate Matter - Control Techniques | Basic Concepts in Environmental Sciences | APTI | USEPA ." US Environmental Protection Agency. N.p., 23 Jan. 2010. Web. 26 Nov. 2010. < http://www.epa.gov/apti/bces/>

Figure 4 & 5 (left and right): Student researchers collecting data near the 580 Freeway locations.





# Conclusion

## References

