the air you breathe

AN INTRODUCTION TO THE COMMUNITY AIR MONITORING PROJECT
at UCLA's University Village Apartments.

September 2018

content

A message from Dr. Yifang Zhu:
We are so thrilled to be working on this air monitoring project with your community. With your help, we can gain a better understanding of how freeway emissions impact the air quality in neighborhoods like yours and the many other near-freeway communities across Los Angeles. Our hope is that the new air sensors located throughout your community and within select apartments will empower you to gain a better understanding of what is in the air you breathe, allowing you to take measures to protect your family's health and wellbeing. As a former resident of University Village Apartments, I know just how important it is to have access to this information, which is why all of the data from our air sensors are publicly available online in real time. Please do not hesitate to reach out if you have any questions, feedback, or ideas about ways we can work together to make this project impactful for your community. I look forward to working with you all throughout the next year.

Best,

Yifang Zhu

Professor of Environmental Health Sciences, Fielding School of Public Health

Air quality in your neighborhood

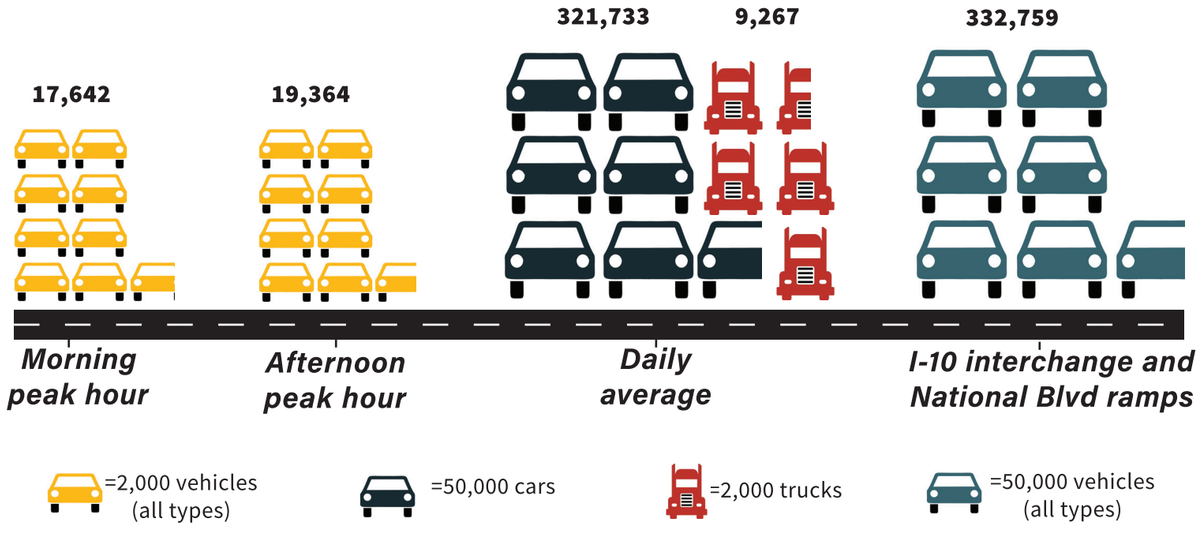
Each community has unique characterstics that contribute to the outdoor air quality.

YOUR'S INCLUDE:

- **DISTANCE TO THE 405: APPROX. 45 METERS**
- **TRAFFIC VOLUMES ON THE 405 NEAR YOU**
- **LOCALIZED WIND PATTERNS**

Pollutants associated with freeways include particulate matter (PM), ozone, volatile organic compounds, and oxides of nitrogen. The amounts of these pollutants in your community are directly related to your proximity to the freeway, the number of vehicles using the road each day, and wind patterns. During peak hours and during the day, you can expect the highest levels of pollutants ouside, while at nighttime pollutant levels are generally the lowest.

TRAFFIC VOLUMES ON THE 405 NEAR YOU

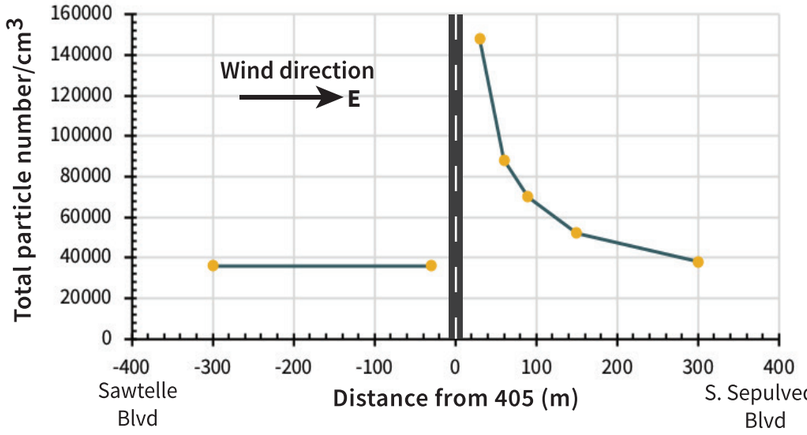


Predominant wind patterns influenced by the local geography create unique air quality patterns that vary by location and time of day.

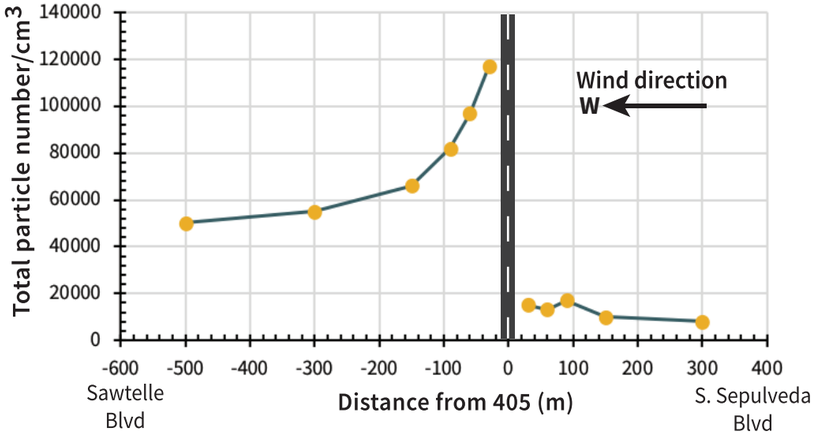
During the day, the breeze blows inland from the ocean, which means that the S. Sepulveda Blvd side of the apartment complex is downwind of the freeway. At night, the winds reverse and freeway pollution blows towards the Sawtelle Blvd units. Another noticeable trend is that PM is lowest at night time overall.

The graphs to the right show how PM varies with distance from the 405 during the day and at night. The data from these graphs was collected by Dr. Yifang Zhu in 2005 at the Los Angeles National Cemetery, approximately 3 miles north on the 405 from your community. While these graphs are useful for illustrating the general patterns of how PM varies by time of day, keep in mind that traffic volumes have increased significantly, vehicles have become cleaner, and the conditions at the cemetery are not necessarily the same as in your community today.

Day PM Spatial Profile



Nighttime PM Spatial Profile



Particulate Matter 101 figures

What is particulate matter (PM) and why should it be important to you?

WHAT IS PM?

Particle pollution, or particulate matter (PM), is a general term used for a mixture of solid particles and liquid droplets found in the air. PM is one of the major pollutants associated with freeways and has a number of serious health impacts. Particles are both directly emitted into the air and can be formed by chemical reactions between other pollutants. The image on this page shows the views of several different types of PM under a microscope.

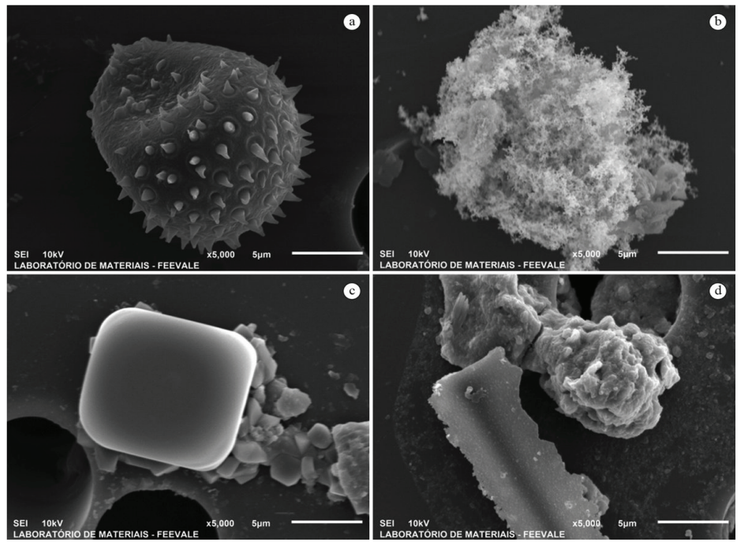
HOW IS IT CLASSIFIED?

Particles range in size and composition. Some are large enough to be seen as dust or dirt; others are so small that they can only be detected with an electron microscope. Most commonly, measurements focus on two size ranges – particles less than 10 microns in diameter (coarse particles, $PM_{2.5\text{-}10}$) and particles less than 2.5 microns (fine particles, $PM_{2.5}$). Particles less than 0.1 micron in diameter are called ultrafine particles, which can be emitted during the process of fuel combustion. The PurpleAir sensors located throughout your community measure both coarse and fine particles (specifically PM_{10}, $PM_{2.5}$,and $PM_{1.0}$), but not ultrafine particles. The figure on the following page illustrates the different sizes of PM in comparison to a human hair.

HOW DOES IT AFFECT HEALTH?

The fine and coarse particles have different sources, properties, and effects. Many of the known environmental impacts are attributed to $PM_{2.5}$. PM has been shown to cause premature death in people with heart or lung disease, heart attacks, stroke aggravated asthma, decreased lung function, lung cancer, and difficulty breathing. In 2015, an estimated 4.2 million people perished due to $PM_{2.5}$ exposure, putting it in the top five mortality risk-factors worldwide.

Particle size is directly linked to the potential for causing health problems. Larger particles, like PM_{10}, impact the upper respiratory tract while smaller particles, like $PM_{2.5}$ and ultrafine particles, can enter the lower respiratory tract and cross into the bloodstream.



(a) a particle of biological origin in the PM_{10} size range
(b) soot particle in the PM_{10} size range
(c) unknown cubic particle in the PM_{10} size range
(d) suspended soil particle in the PM_{10} size range

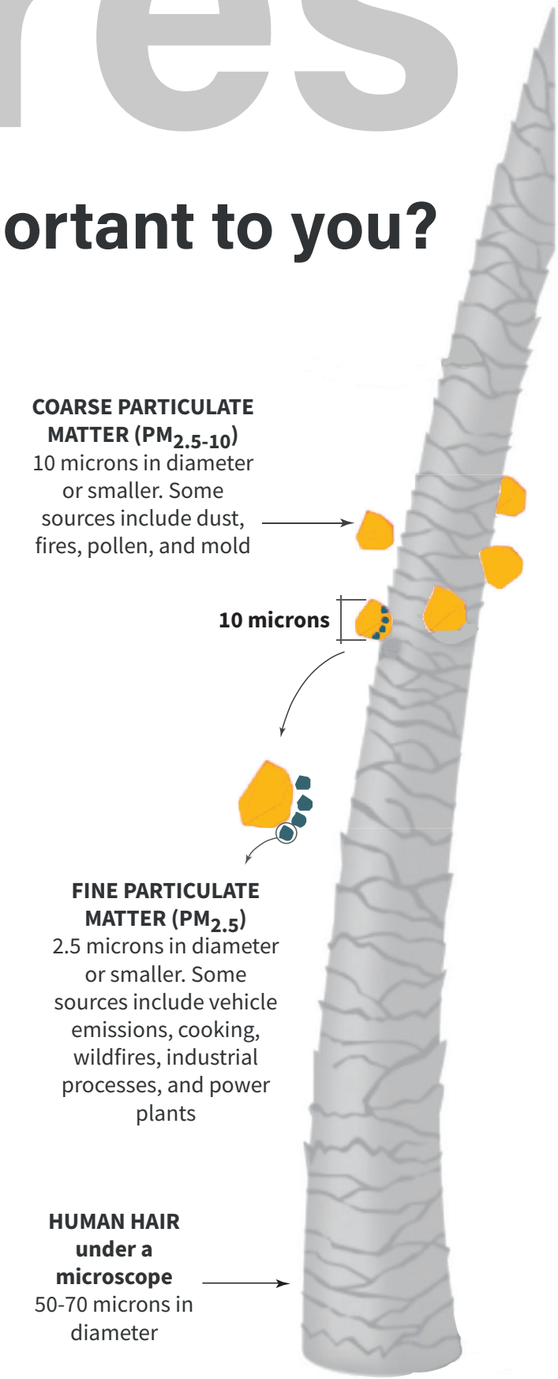
Source: Feevale University

WHAT ARE THE REGULATIONS?

The U.S. Environmental Protection Agency (EPA) sets National Ambient Air Quality Standards (NAAQS) to protect human health. These standards stipulate that the average PM concentration in the outdoor air over a 24-hour and 1-year time-period should not exceed a certain threshold, based on the findings of health and risk assessments. The US standards for $PM_{2.5}$ and PM_{10} are shown in the table below, along with the standards adopted by other nations and the World Health Organization.

PM AIR QUALITY STANDARDS AROUND THE WORLD

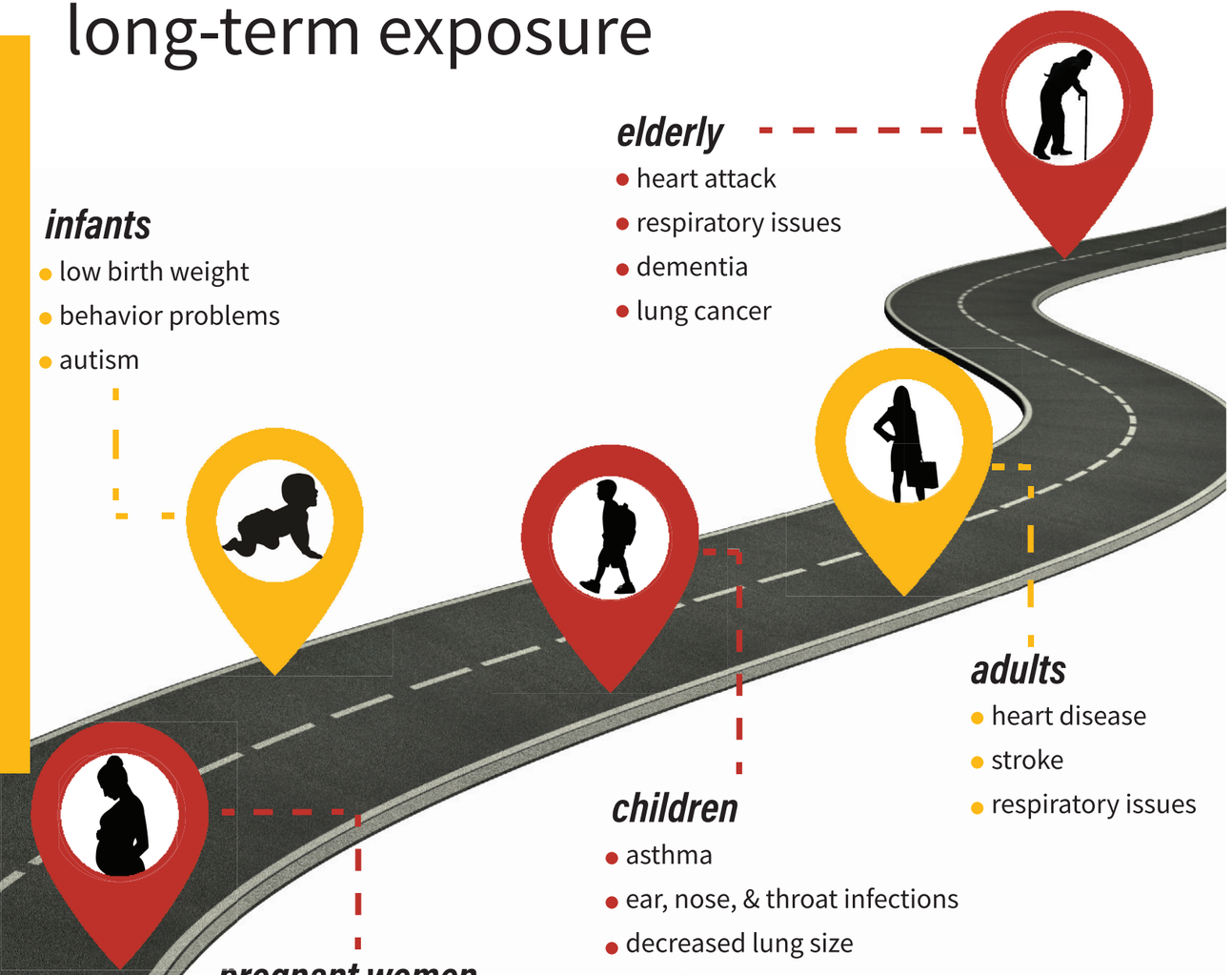
Organization		$PM_{2.5}$ (ppb)	PM_{10} (ppb)	Time average
United States		35	150	24-hour
		12		1-year
Canada		30	none	24-hour
European Union		25	40	1-year
Australia		25	50	24-hour
		8		1-year
China	rural	35	50	24-hour
	urban	75	150	
	rural	15	40	1-year
	urban	35	70	
Mexico		45	75	24-hour
		12	40	1-year
World Health Organization		25	25	24-hour
		10	10	1-year



Graphic adapted from South China Morning Post

FREEWAY POLLUTION

potential health effects of long-term exposure



infants
- low birth weight
- behavior problems
- autism

elderly
- heart attack
- respiratory issues
- dementia
- lung cancer

adults
- heart disease
- stroke
- respiratory issues

children
- asthma
- ear, nose, & throat infections
- decreased lung size
- obesity
- leukemia

pregnant women
- high blood pressure
- decreased fertility
- premature birth

Graphic adapted from the USC Environmental Health Centers

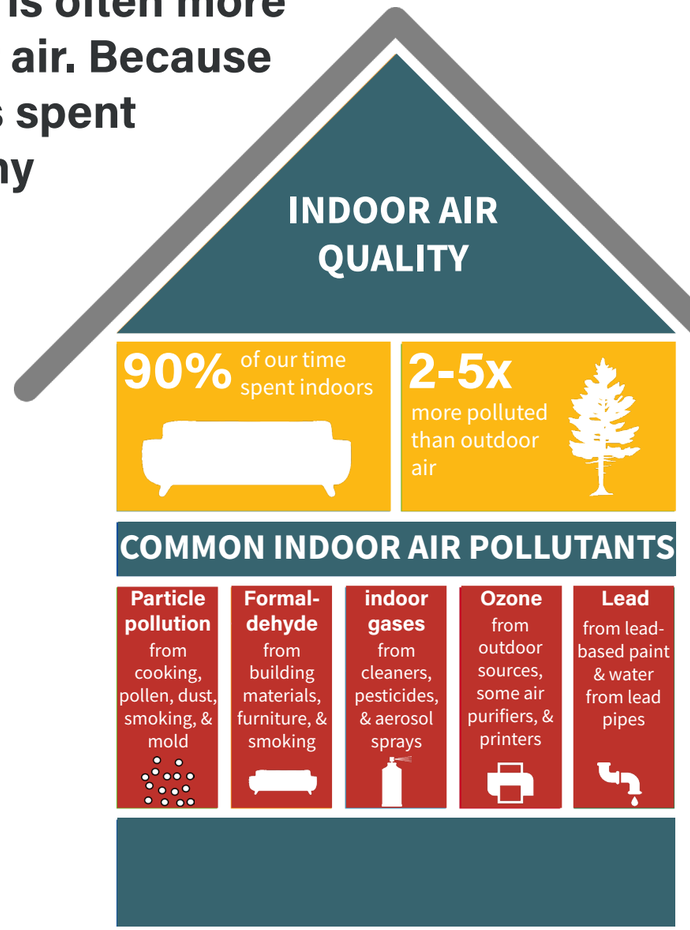
indoor Air Quality

It might be hard to believe in a place like LA, but indoor air is often more polluted than outdoor air. Because so much of our time is spent indoors, having healthy indoor air quality is critical.

Ways to improve indoor air:

- OPEN WINDOWS IF AQI* IS GOOD
- USE VENTS WHEN COOKING
- USE AIR PURIFIERS IN THE HOME
- USE A HEPA-BAGGED VACUUM
- AVOID BURNING CANDLES
- DON'T SMOKE/VAPE INDOORS
- USE NON-TOXIC CLEANERS
- PLACE PLANTS IN YOUR HOME
- DUST HOME OFTEN
- KEEP HUMIDITY LOW

*AQI= Air Quality Index



Graphic adapted from the EPA Exposure Assessment Tools Media

the project

Project basics:

- 12 OUTDOOR AIR SENSORS, 6 ON EACH SIDE OF THE 405
- OUTDOOR AIR SENSORS PLACED ON ROOFS THROUGHOUT COMPLEX
- 18 INDOOR AIR SENSORS IN SELECT APARTMENTS
- AIR SENSOR BRAND: PURPLEAIR
- SENSORS RECORD PM1.0, PM2.5, PM10, TEMPERATURE, AND HUMIDITY
- SENSOR DATA PUBLICLY AVAILABLE IN REAL TIME AT PURPLEAIR.COM
- PROJECT LENGTH: 1-YEAR AT A MINIMUM

Above: project map with outdoor air sensor locations.

Low-cost air sensors, like the PurpleAir sensor used in this project, present an exciting opportunity to supplement data from EPA monitoring stations to help us better understand local-scale air pollution and to involve citizen scientists and community organizations in the knowledge-making process. This study aims to evaluate how low-cost sensors compare to traditional air monitoring devices, gain a better understanding of how freeway emissions impact the air quality in neighborhoods like yours, and learn more about users' experiences with these devices. Our hope is that these air sensors will become a useful tool for community members by helping residents gain a better understanding of the air quality here, why it is important to their families' wellbeing, and what measures can be taken to protect their health.

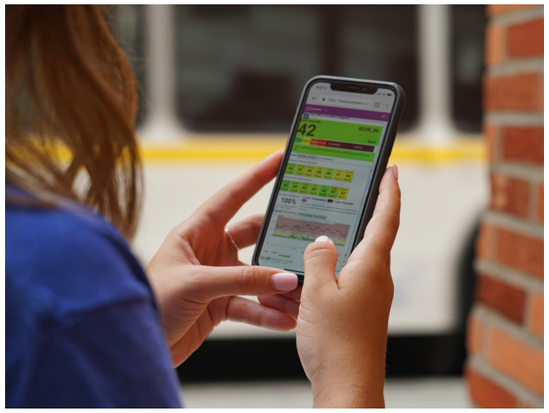
For this project, a PM sensor was selected due to the impacts of PM on health and because it is one of the major pollutants associated with vehicles. Testing by the South Coast Air Quality Management District (SCAQMD) indicates that this sensor is ideal for studying air quality near freeways because of its accuracy and ease of use. The sensors are mounted outdoors throughout the community and inside select apartments, transmitting data in real-time. Everyone in the complex, as well as the general public, is able to view the real-time sensor data on the PurpleAir website, helping you become informed about the air quality in your area, plan outdoor activities accordingly, and manage your indoor air quality. The map to the left shows where the outdoor sensors are located. You can use the building numbers to locate your apartment number and determine which sensor is closest to your home.

Indoor Air Quality

results

PRELIMINARY FINDINGS ON INDOOR AIR QUALITY AT UNIVERSITY VILLAGE

We analyzed data from 12 indoor air sensors. Here's what we learned:



Above: PurpleAir II user viewing air sensor data on a mobile device.

BACKGROUND

Using data from twelve project participants with indoor air sensors, we have found some interesting preliminary results about indoor air quality and household activities. Participants provided a baseline survey containing questions about home characteristics, cleaning activities, air purifier use, and cooking activities and also filled out a detailed activity log containing activities known to impact air quality. This information was compared to the hourly indoor and outdoor PM concentrations recorded by the PurpleAir sensors in the apartment complex.

RESULTS

We found clear relationships between certain household activities, like cooking and air purifier use, and the indoor air quality. Common activities like cooking and vacuuming caused PM concentration spikes, as shown in data taken from **Apartment B** on the following page. According to the data and resident activity logs, cooking can increase PM levels 5 to 20-fold, depending on the cooking type (e.g. boiling, frying, grilling), while vacuuming increases PM levels by 5 to 10 times. These PM concentration peaks returned to normal levels nearly five times more quickly when the stove fan was used during cooking compared to when it was not used. We also learned that another important contributor to indoor PM levels is candle use. One resident decided to conduct an experiment by burning a candle for one hour to see how it would influence the indoor air quality. We found during that hour, the indoor PM concentrations were 50 times higher than normal.

We also found that air purifiers play an important role in decreasing indoor PM level. We classified apartments by how often they used an air purifier (all the time, sometimes, and never) and compared this to their indoor $PM_{2.5}$ concentrations. We found that there are significant differences in $PM_{2.5}$ concentration between apartments with different air purifier usage frequencies, with those using air purifiers all the time showing the best indoor air quality. For example, apartments that did not use an air purifier had approximately 10 times higher concentrations of $PM_{2.5}$ than apartments that used an air purifier all day. While household activities seemed to have the strongest impact on indoor air quality, we found that the outdoor air quality has effects too. We found that, in times of no indoor activity, indoor air quality is highly related to outdoor PM level. For example, in some apartments, we saw small increases in PM levels in the early morning, likely related to the morning rush hour.

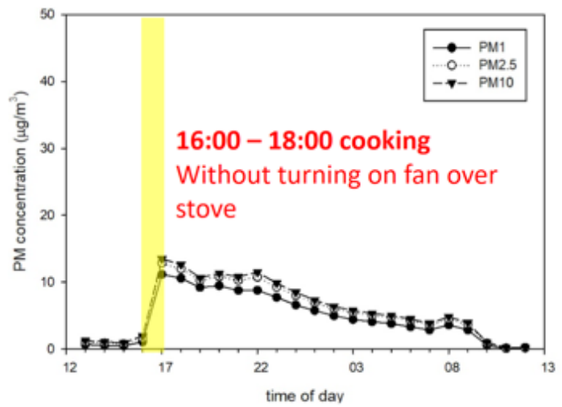
CONCLUSIONS

So far, we have found that outdoor air quality influences the concentration of PM indoors and that candle burning, cooking, and vacuuming can contribute to poor indoor air quality. We know that for most families, these are necessary activities. So, we are excited to say that our preliminary results indicate some simple measures families can take to improve their indoor air quality and protect their health. We found that taking steps like using the over-stove vent while cooking can help to quickly reduce the PM levels in your apartment. Likewise, keeping your air purifier turned on for most of the day is another great way to improve indoor air quality. As we collect more data and conduct further analysis, we will look for more ways that people can improve their indoor air quality at University Village.

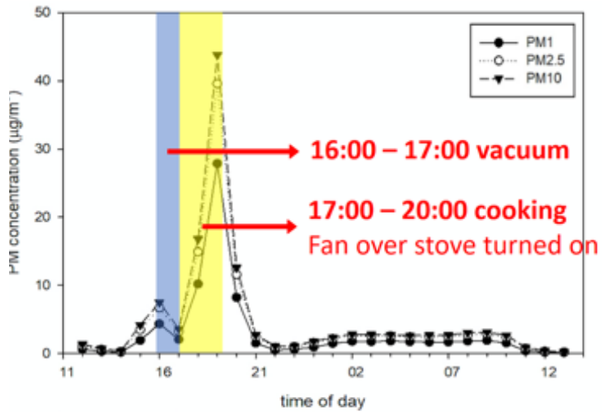
If you are interested in getting an air purifier for your home and need help selecting one, check out page 17 for some tips.

KEY FINDINGS:

- **THE MORE YOU USE YOUR AIR PURIFIER, THE BETTER THE INDOOR AIR QUALITY**
- **USING THE OVERHEAD FAN WHILE COOKING HELPS TO QUICKLY DECREASE INDOOR PM LEVELS**
- **CANDLE BURNING CAN INCREASE INDOOR PM LEVELS BY UP TO 50X THE NORMAL CONCENTRATION**
- **COOKING CAN INCREASE INDOOR PM LEVELS BY 5-20X THE BASELINE CONCENTRATION**
- **WHILE VACUUMING, PM LEVELS CAN INCREASE BY 5-10X THE BASELINE CONCENTRATION**
- **INDOOR PM LEVELS ARE SLIGHTLY ELEVATED DURING TIMES OF HEAVY TRAFFIC**



Hourly PM concentration data of **Apartment B** over Day 1 of activity log

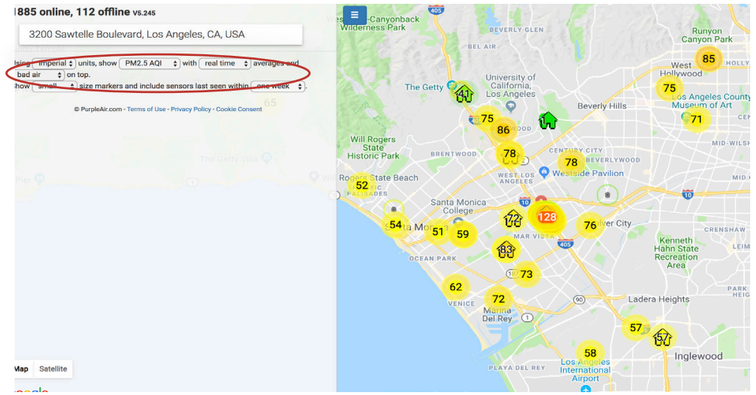


Hourly PM concentration data of **Apartment B** over Day 2 of activity log

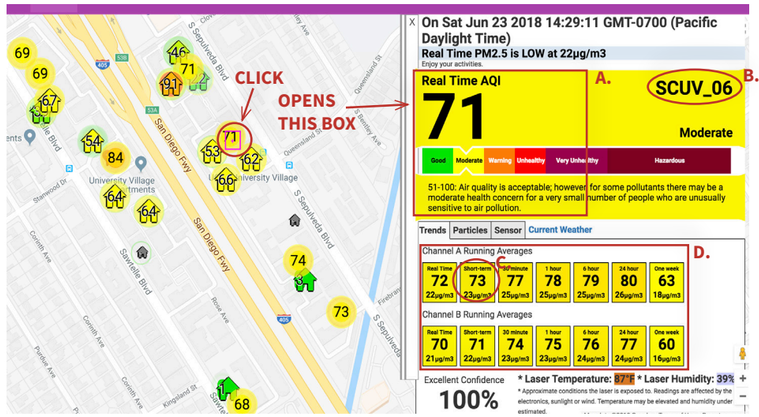
supplement

Interested in viewing the data?

To view the data from the air sensors located throughout your apartment complex, take the following steps:
1. Go to www.purpleair.com/map
2. Type in your address in the search bar in the upper left corner of the map as circled below:



3. Click on the dot for the sensor you are interested in viewing (dots indicate outdoor sensors, houses respresent indoor sensors):



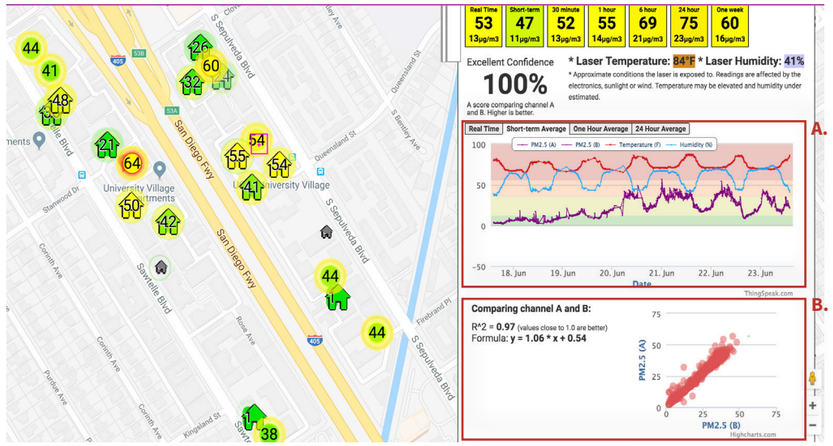
4. A box will open on the right side of the map with all of the information from the sensor
5. Description of information in box:
    A. Near the top of the box, you will see a number (in this case “71”) that indicates the real-time AQI. The AQI is measurement based on the EPA’s national outdoor air quality standards. The AQI will give you information as to how clean the air is and whether certain susceptible people (e.g. people with asthma, cardiovascular disease, or other respiratory issues) should avoid being outside at a given moment.

Data viewing

Continued from pg. 15:

B. SCUV_06 is the name/label of the sensor
C. “23 µg/m³” indicates the PM2.5 mass concentration, while “73” indicates the corresponding AQI.
D. Each unit has two individual raw sensors inside the device called Channel A and Channel B. They should report approximately the same readings. “Channel A Running Averages” and “Channel B Running Averages” show the real time, short term, 30-minute, 1-hour, 6-hour, 24-hour, and 1-week average PM2.5 levels.

6. If you scroll further down in the side menu for the sensor, you will see the following:



7. “A.” i. shows a graph of the PM2.5 short-term average readings over time (you can view the real-time, 1-hour, and 24-hour averages by clicking the tabs above the graph). “B.” shows the regression graph between the two raw sensors inside the unit. The closer the R^2 value is to 1, the more similarly the two raw sensors are recording the PM2.5 data (we want to see R^2 values close to 1).

Note: these sensors also record PM1.0 and PM10, but these values are not shown on the map. If you would like to know the recordings for PM1.0 and PM10, you can download the sensor data by doing the following:

1. Go to https://www.purpleair.com/sensorlist.
2. At the top, choose your date range for the data you would like.
3. Then find the sensor you want information from (use ctrl F or command F on a mac to search) and select the sensor by checking the box next to it.
    a. Sensors are titled “SCUV_##”. The exact number depends on which sensor you are interested in.
    b. Note: You will see an “a” and “b” option for your sensor. This is because each sensor contains two identical laser particle counters, each reporting similar, but potentially slightly different values. For more information about the sensor specifications visit https://www.purpleair.com/sensors
4. Click Download Selected at the top right of the page. Download will start CSV file download.

Selecting an air purifier

As our preliminary results have shown, using an air purifier in your home can drastically help to improve the indoor air quality. In the infographic below, we provide low, moderate, and higher cost options for air purifiers that can be purchased online. All of the air purifiers shown below have been tested and certified by the California Air Resources Board (CARB) and are effective for use in rooms that are the typical size of the open floor plan living room and kitchen found in the University Village apartments. If you plan to place an air purifier in your bedroom, visit http://www.ahamdir.com/ and search for options that are effective in a room greater than or equal to the square footage of the room in question.

AIR PURIFIERS

California Certified Air Cleaning Devices available online

$

- Honeywell 50250-S True HEPA Air Purifier: $130.99
- Winix 5300-2: $139.99
- Winix 5500-2: $150.99
- 50250-S True HEPA Air Purifier: $195.91
- Honeywell HPA300 True HEPA Allergen Remover: $199.99

$$

- Whirlpool WP1000: $239.69
- Whirlpool WP500: $239.96
- Blue Pure 211+: $249.35
- Electrolux ELA P40D8PW PureOxygen Allergy HEPA: $289.63
- Blueair 403 HepaSilent Air-Purification System: $399.99

$$$

- Sharp KC-860U: $421.99
- Blueair Classic 405 HepaSilent: $549.95
- Cuckoo CAH-4011FW: $600.00
- Philips Air AC5659/40 5000i: $699.99
- Atmosphere 10176: $888.88
- Oransi EJ120: $899.00

THANK YOU FOR READING

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