

# Lab 3: Air Quality

September 14, 2022

Mason McBride

## 1. Film Discussion [6 pts]

Collaborators:

Eduardo Sanchez

Peter Du

		<i>Inconvenient Truth</i>	<i>Under the Dome</i>
1	Central Argument	Global Warming is an inconvenient truth that we (citizens and policymakers) would rather ignore for the sake of comfort.	The air pollution in china
2	Topics	Global warming, Icebergs melting, sea levels rising, greenhouse gasses	Air pollution, birth defects, energy companies, coal companies, steel producers,
3	Objectives + Scope	Objectives: Wake up the American people Scope: The perceptions of each American citizen and each American policymaker. Large scope.	Objective: Make Chinese citizens care about pollution and what they can do to prevent it. Scope: The individual citizens of China
4	Structure + Presentation + Communication Style	Statistics, presentation, speech, pictures,	Personal experience, data, message to people
5	Application of Science	Develop new technologies that can slow down the environmental crisis, such	Different methods of improving pollution with new technology such as

		as more efficient fuels	vehicle air purifier and usage of more natural gas
6	Learned Lessons	By showing irrefutable statistical evidence, <i>Inconvenient Truth</i> convinces us that we can not exploit/pollute the Earth anymore.	Reduce all types of pollutants from greenhouse gasses to coal burning to help save earth from melting down and causing irreversible damage to human life. Also, proved to us that there are solutions and technologies that work we just need to compliment them to everyday life styles

## 2. Particulate Matter and Air Quality Index.

AQI is short for Air Quality Index and is used by the US to show how polluted the air is. AQI is made up of all pollutant concentrations. The pollutants in AQI are PM, Ozone, SO<sub>2</sub>, NO<sub>2</sub>, and CO. Their concentrations in the air are measured by the number of particles per area. These concentrations very accurately reflect the number of different pollutants in the air. These concentrations are used to calculate the AQI value but the pollutant concentrations are averaged when calculating. Only the main pollutant is considered when adding the AQI value. This makes AQI different from these pollutant concentrations and is used more as a communication device.

## 3. Case Study

Create a case study of air quality for a city. Identify a place with poor air quality. The place can be based on the experience of a group member or an exploration of maps. Please follow your interests.

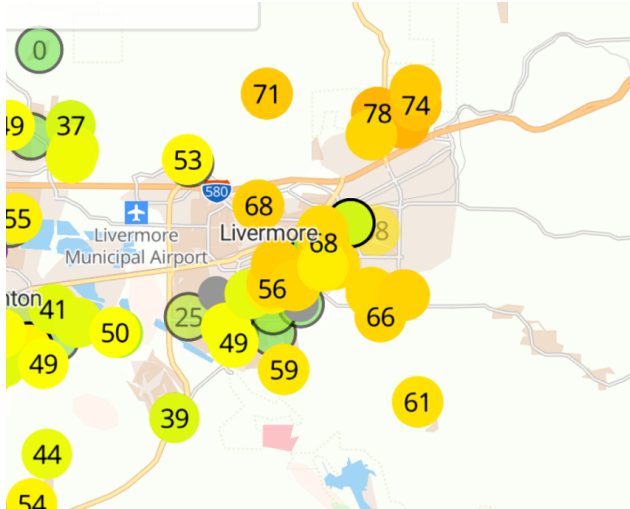
### 1. The full names of collaborators in your group

Mason McBride  
Daniel Tan  
Melissa Wright

### 2. City Name

## Livermore, CA

3. City Location – insert a map showing your location (i.e., screenshot of an aerial view from Google Maps, Google Earth, ArcMap, etc.)



(“Real-Time Air Quality Map | PurpleAir” 2022)

4. What air pollutants impact the city?

Mostly PM<sub>2.5</sub> pollutes the city of Livermore. (“Real-Time Air Quality Map | PurpleAir” 2022) PM<sub>2.5</sub> is generally created by the fossil fuel combustion process of motor vehicles. The other kinds of pollutants remain at low levels.

5. Describe local conditions that could influence air quality. What are the sources of these air pollutants?

There is a freeway, an airport, and a school (“Real-Time Air Quality Map | PurpleAir” 2022) which all increase the presence of motor vehicles and thus PM<sub>2.5</sub> in the ambient air.

6. If you can find information, summarize health concerns in the area that can be associated with air pollution.

For PM<sub>2.5</sub>, short-term exposures (up to 24-hours duration) have been associated with premature mortality, increased hospital admissions for heart or lung causes, acute and chronic bronchitis, asthma attacks, emergency room visits, respiratory symptoms, and restricted activity days. (California Air Resources Board 2015)

Long-term (months to years) exposure to PM<sub>2.5</sub> has been linked to premature death, particularly in people who have chronic heart or lung diseases, and reduced lung function growth in children. (California Air Resources Board 2015)

7. What (if anything) has been done by the city to address air quality issues.

In 2004 the city of Livermore made policies related to air pollution in the city's general plan: (City of Livermore 2019)

Objective OSC-6.1: Minimize air pollution emissions.

Policies:

P1. The City shall require project developers to develop and implement a construction- period air pollution control plan, consistent with dust and emission abatement actions outlined in the CEQA handbook of the Bay Area Air Quality Management District.

P4. All industrial uses within Livermore shall meet regional, State and federal air pollution standards.

P5. The City shall attempt to increase the employment to population ratio to reduce commuting rates and associated vehicle-related pollution emissions. The City shall approve only those development proposals, which are designed and located to minimize energy consumption and adverse impacts on air, land and water resources. High-density, transit-oriented developments shall be strongly encouraged and promoted through the use of specific planning, density transfer, the planned development concept, and zoning designations.

8. Track and cite your sources. In addition to the air quality maps and resources, you can research and cite reports, newspaper or research articles, or your own local knowledge. Use in-text citations and include a reference section.

California Air Resources Board. 2015. "Inhalable Particulate Matter and Health (PM<sub>2.5</sub> and PM<sub>10</sub>) | California Air Resources Board." Ca.gov. 2015.  
<https://ww2.arb.ca.gov/resources/inhalable-particulate-matter-and-health>.

City of Livermore. 2019. "225 N. Greenville Road Project Draft Initial Study/Mitigated Negative Declaration." 225 N. Greenville Road Project Draft Initial Study/Mitigated Negative Declaration. City of Livermore. January 2019.

<https://www.livermoreca.gov/home/showpublisheddocument/1437/637181918665030000>  
“Real-Time Air Quality Map | PurpleAir.” 2022. Map.purpleair.com. September 12, 2022. <https://map.purpleair.com/1/mAQI/a10/p604800/cC0#1.08/0/-30>.

#### 4. Air Quality Data Collection. Field Research

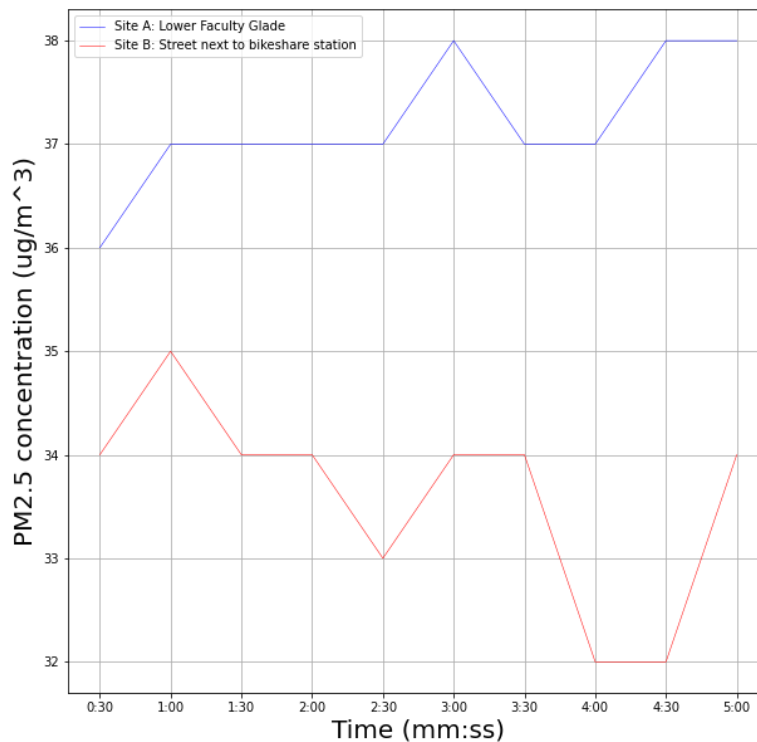
Collaborators:

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4.1. **Create a time series graph** for concentrations of particulate matter at each of the two sites you measured them. [4 pt]

Lower Faculty Glade and Street next to Bikeshare Station  
Particulate Matter levels on September 9, 2022



4.2. What was the PM2.5 max, min, and average concentrations for each site in ( $\mu\text{g}/\text{m}^3$ )? [2 pt]

Location 1 (Faculty Glade): min =  $36\mu\text{g}/\text{m}^3$ , max =  $38\mu\text{g}/\text{m}^3$ , mean =  $37.2\mu\text{g}/\text{m}^3$

Location 2 (Bikeshare Station): min =  $32\mu\text{g}/\text{m}^3$ , max =  $35\mu\text{g}/\text{m}^3$ , mean =  $33.6\mu\text{g}/\text{m}^3$

4.3. What are the main differences in air quality between the two sites you conducted the measurements of PM 2.5 concentrations? [2pt]

The air quality in both locations was opposite of what I initially expected. I expected the air quality on campus to be lower than the air quality near the road. In reality, the PM2.5 concentration near the bikeshare location never reached the concentration on the faculty glade. The main reason for this difference is actually that airflow is better near the bikeshare location than the faculty glade. The bikeshare location was on the top of a hill and heavier particles like PM2.5 would be more likely to flow down their hill leaving that area less polluted, as opposed to the enclosed faculty glade layout.

4.4 What are plausible reasons for similarities or differences? [2 pt]

Usually vehicles are a main PM2.5 polluter, but buses in Berkeley are minimal polluters and bike-sharing and scooters keep vehicle pollution down. Furthermore, since common indoor activities are also a contributor to PM2.5, this could explain why the air around the faculty glade actually gets higher PM2.5 levels than the “clean” streets near Bancroft Way. Or, there could be lots of air conditioning units in the area as well as smokers and cooking areas. The slight difference could also be from the construction/renovation of a building right next to the faculty glade, and tiny particles could be a side effect from that process.

4.5 Convert the calculated mean PM2.5 measurements, for each site, to the EPA’s air quality index (AQI). [2pt]

Location 1: AQI = 105

Location 2: AQ2 = 96

4.6. How do those measurements compare to the AQI in Berkeley today? Make sure you are comparing the same units of measurement. And how your measurements compare to air quality measurements from purple air sensors on campus (make sure that you check if those purple air sensors are indoor or outdoor sensors). [3 pt]

The AQI measurement is 107 in Berkeley today. It is very similar to our location 1 AQI just slightly worse. We went up from 105 to 107.

4.7 What are the advantages and limitations of point source measurements in comparison with the other data sources mentioned above? [3pt]

The limitations for point source measurements are that is limited to the small area you are measuring. Purple air takes the average of the entire city through their sensors placed by citizens and calculates the average for pm2.5.