

GIS Project _San Pedro Bay Area Quality Analysis

Background

The Port of Los Angeles (POLA) and the Port of Long Beach (POLB) have adopted 'San Pedro Bay Ports Clean Air Action Plan' (CAAP) for 10 years. (CAAP website, 2016) The plan aimed at reducing the health risks posed by air pollution from port-related ships, trucks, cargo handling equipment and harbor craft. (CAAP website, 2016)

'The port complex is the single largest source of air pollution in the region, with trucks and ships spewing smog-forming pollutants and cancer-causing diesel particles.' (The Times Editorial Board, 2016) Emit diesel particulate matter (DPM), nitrogen oxides (NOx) and sulfur oxides (SOx) substantially affect human health and contribute to the formation of smog. (CAAP website, 2016) The port complex claims, 'since 2005, port-related emissions have dropped 85% for diesel particulate matter, 50% for nitrogen oxides, and 97% for sulfur oxides'. (CAAP website, 2016)

This GIS report analyzes the index of air quality of San Pedro Port Complex from 2008 to 2015. POLA and POLB offer charts from six monitor stations. The geo-based map visualizes the data and present the result in the map. The map is also helpful to understand air pollution patterns and trends. The GIS-based is an appropriate tool for making matter decisions for future air clean action.

Data Sources

The data comes from report of POLA and POLB:

a. Air Quality Monitoring Program at the Port of Los Angeles Year Ten Data Summary

May 2014 - April 2015

b. Air Quality Monitoring Program at the Port of Long Beach FINAL Annual Summary

Report Calendar Year 2014

Several kinds of target data have been identified from 2008 to 2014: Ozone (O₃), Carbon Monoxide (CO), Nitrogen Dioxide (NO₂), Fine Particulate Matter (PM_{2.5}).

These parameters are complied with California and National Ambient Air Quality Standards. The recorded data shows a clear trend of air quality change and they are easy to be combined with spatial maps.

Data collection and preliminary processing

First, I add the basemap of 'World Light Gray Canvas Base' from GIS online, and zoom into the scope of San Pedro Bay Area.

Then I check the locations of 6 monitoring stations in the POLA and POLB. I built a new layer called 'AirQualityMonitorStation' to input point shape. I edit the layer and name them as 'POLA_outer_Harbor', 'POLA_San_Pedro', 'POLA_Terminal_Island', 'POLB_Outer_Port', 'POLB_Inner_Port' and 'POLA_Wilmington'.

I set a .5 Mile Buffer for each station to show the monitoring coverage to local communities. The 'AirQualityMonitorStation_BufferZone' is added into the top level.

After that I add another layer called 'TruckRoute'. Refer to the 'Heavy Container Corridor Map' of Port of Los Angeles, I draw the Polyline shape as the map to show their relationship with locations of air monitoring stations.

The last step is to retrieve the data in the report and integrate it into 'AirQualityMonitorStation' Attribute Table. The data is modified as different types and different years.

GIS Data Operation Procedure

All the related data is stored in 'AirQualityMonitor.gdb'. I set the OBJECTID for 6 monitoring stations in the layer of 'AirQualityMonitorStation'.

By right-click the geodatabase, I select Import > Table (single). In the Table to Table dialog box, I click the browse button to the right of Input Rows, input the Excel file of '10 year air quality monitor data.xlsx'. (Gorr, Kurland, 2016)

After integrating all the data columns into attribute table, I right click the layer > property, and refer to Symbology > Quantities > Graduated Symbols and Charts. The label and class range are manually modified.

San Pedro Bay Area Air Quality Analysis -Monitoring Stations Location

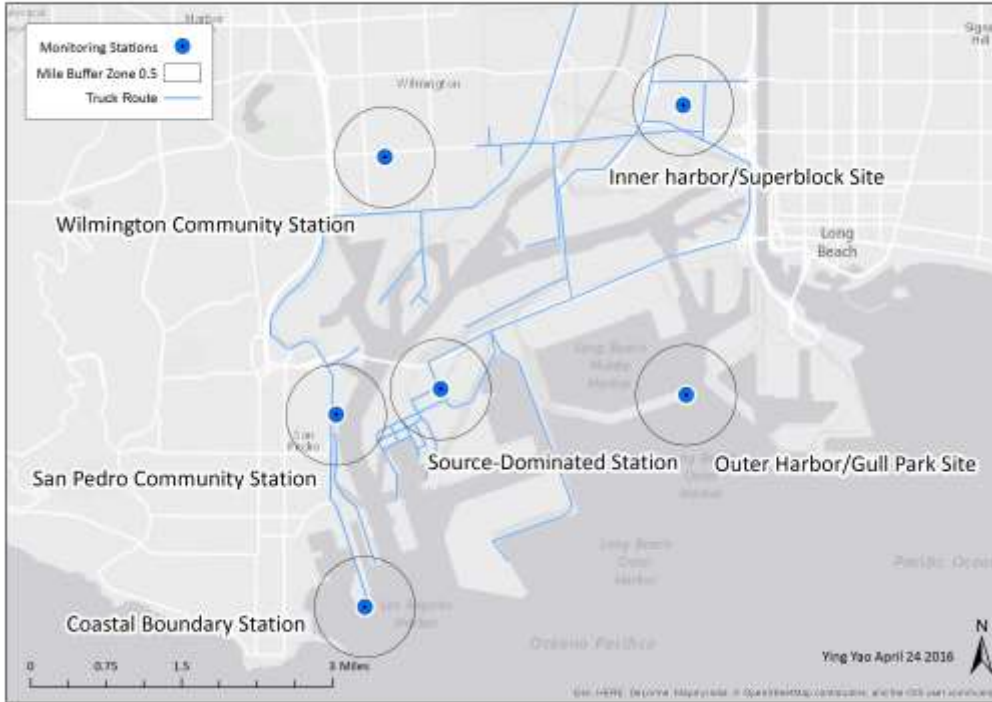


Figure 1. San Pedro Bay Area Air Quality Analysis- Monitoring Stations Location

Figure 2. San Pedro Bay Area Quality Analysis –Annual Average PM 2.5

The maximum 8-hour CO concentrations measured at the 6 stations are relatively stable. The pollutant concentration shows a strong relationship with its location. Inland stations are almost double such as Wilmington Community Station. All of the 8-hour maximum values are far below the 8-hour CO NAAQS and CAAQS of 9 ppm. (POLA report, 2016)

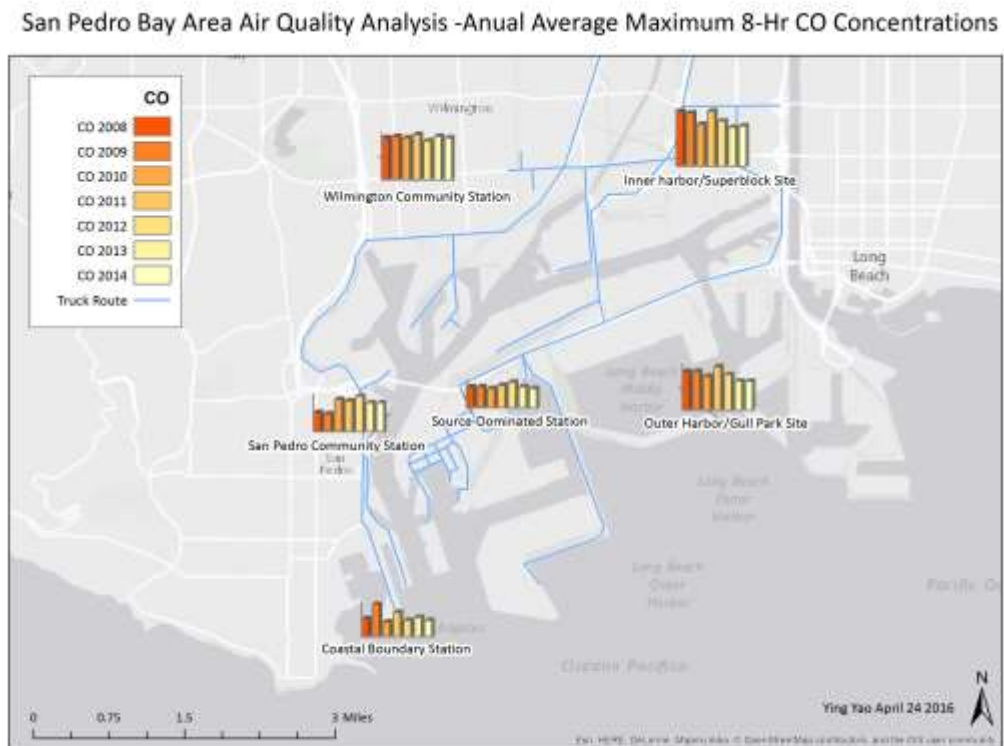


Figure 3. San Pedro Bay Area Quality Analysis –Annual Average Maximum 8-Hr CO Concentrations

The annual NO₂ concentrations also have not exceeded the NAAQS or CAAQS during the period. (POLA report, 2016) The trend is a moderate decreasing, ranging from 24% at the Coastal Boundary station to a 6% at the San Pedro Community station. (POLA report, 2016)

San Pedro Bay Area Air Quality Analysis -Annual Average NO₂

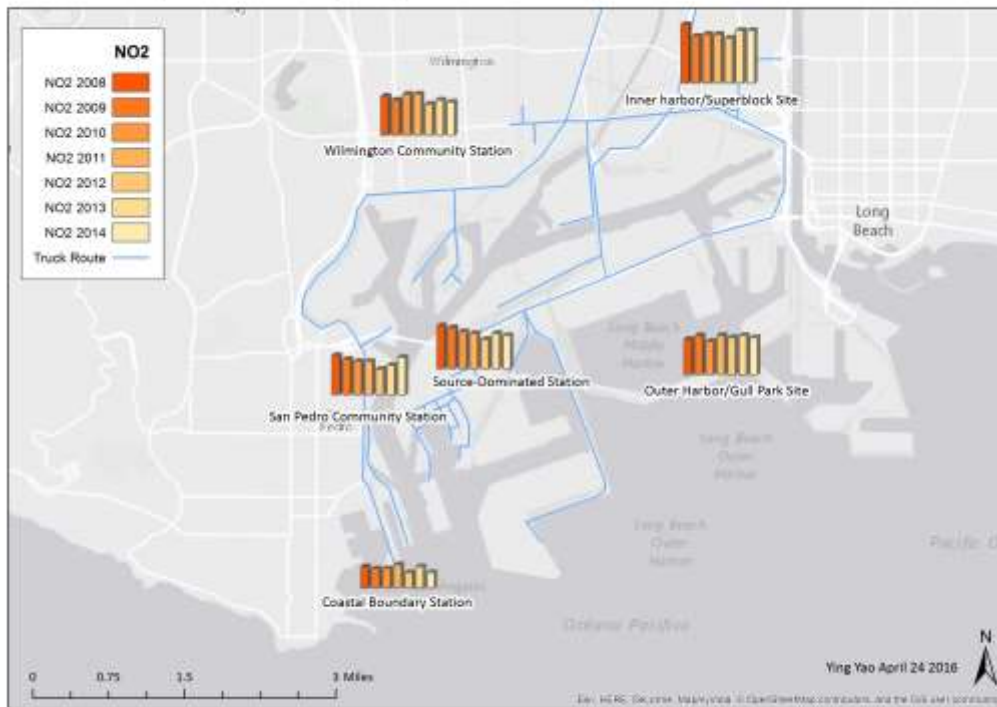


Figure 4. San Pedro Bay Area Quality Analysis –Annual Average NO₂

The maximum 1-hour O₃ concentrations do not show a consistent pattern. The highest values appear in 2010-2011, 4 out of 6 stations exceed the 1-hour CAAQS standard. The other period are similar, most of the data are floating close to the CAAQS hazard line. (POLA report, 2016)

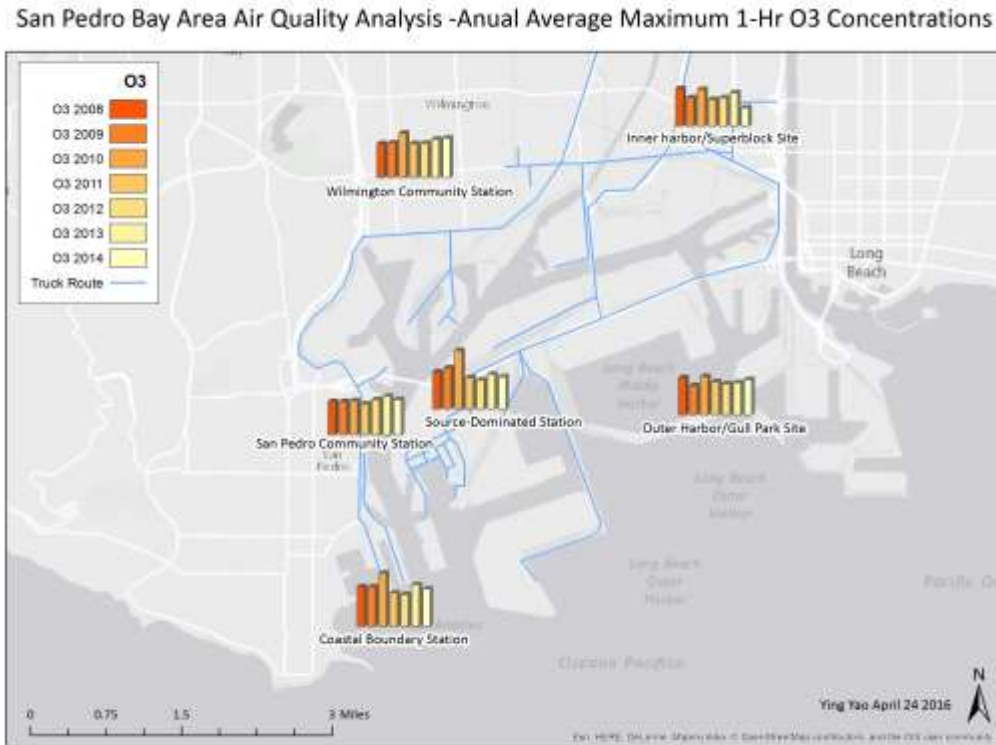


Figure 5. San Pedro Bay Area Quality Analysis –Annual Average Maximum 1-Hr O₃ Concentrations

The annual average concentrations shows an optimistic vision of air clean action. The action effectively cuts the pollutants level. If we make a judgement on the annual average concentration, the PM 2.5 and NO₂ are not a threat to residence health any more. But the 1-hour or 8-hour peak values may not speak in the same language. The

hazard high peak value may still harm people's health and the port hasn't convinced the public what exactly caused that change.

Study Limitation and Future Alternatives

Varied annual average data is used in the map. It doesn't reflect many other character like value of 98 percentile of daily maximum. The time range is also a bit broad for such a subject, the data may change quickly in a day and the high value may exceed the States and National Standard while the average value stay safe. The dataset is not comprehensive enough to make a solid judgement that the port's pollution is no longer a threat to local community residence healthy.

The number of monitor station is limited. With 6 stations settled around San Pedro Bay, I do not find any reliable source of their accurate coverage. I give them a .5 Mile Buffer based on subjective judgement. A more specific study of monitoring station networking may be needed in the future.

Weather condition and traffic volumes are also uncertain factors, the air quality may be affected severely by heavy rain or wind. The climate may also have positive impact the pollutant concentrations.

POLA and POLB public their report in the similar way but with slightly different data types. Data of annual average CO concentration or O₃ concentration can only be find in

Port of Long Beach's report. Thus I select Maximum 8-Hr CO Concentrations and Maximum 1-Hr O₃ Concentrations instead of annual average concentrations.

Reference:

1. San Pedro Bay Ports Clean Air Action Plan, 2016. Retrieved from:

<http://www.cleanairactionplan.org/>

2. The Times Editorial Board, February 5, 2016. L.A. needs fewer platitudes and more action on port air pollution. Retrieved from:

<http://www.latimes.com/opinion/editorials/la-ed-0205-port-pollution-20160205-story.html>

3. Wilpen L. Gorr, Kristen S. Kurland. 2016. GIS Tutorial Basic Book 1. Page 145-148.

4. Port of Los Angeles, 2016. Air Quality Monitoring Program at the Port of Los Angeles Year Ten Data Summary May 2014 - April 2015

5. Port of Long Beach, 2016. Air Quality Monitoring Program at the Port of Long Beach FINAL Annual Summary Report Calendar Year 2014