Action: Mobile monitoring around railyards to evaluate their impact on air quality

Background & Objective

The Community Steering Committee (CSC) prioritized air pollution from railyards within the East Los Angeles, Boyle Heights, and West Commerce (ELABHWC) community as one of their top air quality priorities. There are five railyards in ELABHWC (Figure 1), namely: Union Pacific Railroad Los Angeles Transportation Center Railyard, Union Pacific Commerce Railyard, BNSF Hobart Railyard, BNSF Commerce Eastern Railyard, and BNSF Sheila Mechanical railyard. Air pollution is mainly generated by equipment and vehicles that are used for railyard operations. These vehicles and equipment move containers and railcars into and around the railyard to load, unload, and transport goods in and out of the railyard. Emissions can also be generated during maintenance activities (e.g., load testing). Examples of equipment used for railyard operations include locomotives, drayage trucks cargo handling equipment, transportation refrigeration units, and other miscellaneous equipment such as fuel trucks.

The CSC identified specific actions to identify opportunities for emission reductions from railyards. This includes conducting fenceline and/or mobile air measurements to identify activities that may cause increased levels of air pollution. Mobile air measurements (and fixed air monitoring, when appropriate) could be extended into the community to assess how railyard related emissions may contribute to the overall air pollution burden in this community. If needed, air monitoring can also be conducted to determine source locations and track the progress of emission reduction strategies. A further step to better characterize this air quality concern may also include mobile and/or fixed monitoring near transportation corridors.

Method

Mobile monitoring has been and continues to be conducted with a mobile platform capable of measuring a wide range of particulate and gaseous pollutants, including particulate matter (PM), black carbon (BC), ultrafine particles (UFP), and nitrogen dioxide (NO_2). Figure A-1 shows the routes traversed by the mobile platform around the railyards as well as within the nearby neighborhoods in the ELABHWC community, as well as the location of air monitoring stations for baseline measurements.

Results

- As of July 2020, a total of six days of mobile monitoring was conducted around the railyards and nearby neighborhoods within the ELABHWC community
- Monitoring results indicated elevated concentrations of NO_2, UFP, and BC near and downwind of the railyards within the ELABHWC community but these elevations were not as significant as those observed on major streets, freeways, and freeway off-ramps including I-710, I-5, and 60, Bandini Blvd., Washington Blvd., Santa Fe Ave., and Soto St. (see Attachment A for details)

- It was also observed that NO2, UFP, and BC concentrations were generally lower in residential communities compared to those near railyards and on major streets and freeways (see Attachment A for details)

Next steps

- Continue conducting mobile monitoring
- Use air monitoring data and emissions inventory information to help identify opportunities for emission reductions

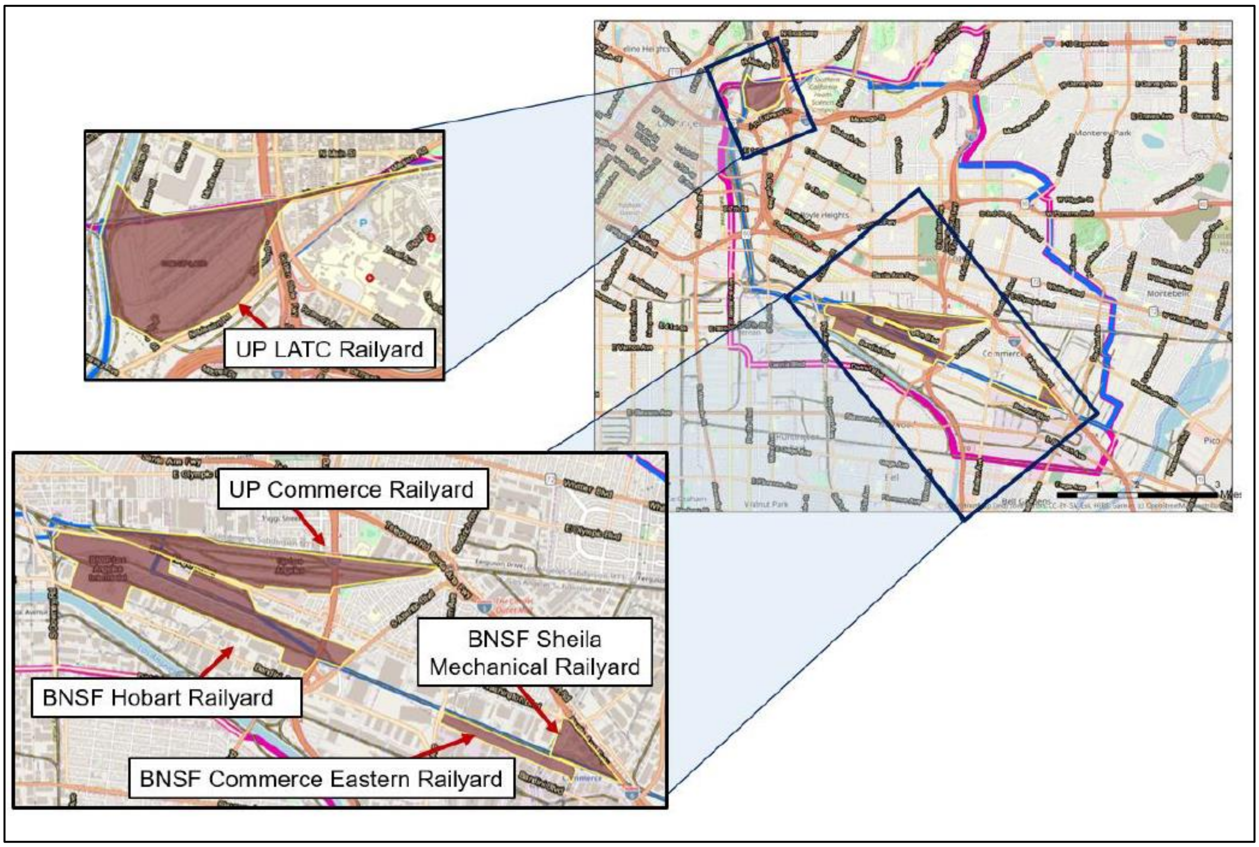

Figure 1. Location of the five railyards within the ELABHWC community

Attachment A

As of July 2020, a total of six mobile monitoring surveys have been conducted in the East Los Angeles, Boyle Heights, and West Commerce (ELABHWC) community to measure diesel emissions. Diesel engines emit a complex mixture of air pollutants, including both gaseous and solid material. The solid material in diesel exhaust is known as diesel particulate matter (DPM), which is a component of PM2.5. There is no technique to directly measure DPM (a major contributor to health risk); therefore, indirect measurements to detect surrogates of diesel exhaust (such as black carbon; or BC) are used instead. DPM is typically composed of carbon particles ("soot", also called BC) and numerous organic compounds. Diesel exhaust also contains gaseous pollutants, including volatile organic compounds (VOCs) and NOx.

Mobile measurements were conducted using a mobile platform capable of monitoring a wide range of particulate and gaseous pollutants, including particulate matter (PM), black carbon (BC), ultrafine particles (UFP), and nitrogen dioxide (NO_2), as part of the area-wide surveys. Nonetheless, the routes traversed by the mobile platform were defined in a way to perform monitoring around the railyards within the ELABHWC community. Typically, measurements from a mobile platform at a given location are relatively short, ranging from seconds to a few minutes when the platform is moving. Therefore, given the high temporal variability of most air pollutants, mobile survey measurements do not necessarily capture the typical air quality conditions of a specific location. One way to address this limitation is to increase the number of passes or transects to obtain a more representative and consistent map of the spatial and temporal variability of the measured air pollutants through repeated measurements. Figure A-1 shows the routes traversed by the mobile platform around the railyards as well as within nearby neighborhoods in ELABHWC. In this figure, number of passes, that is a measure of representativeness of the measured concentrations, is shown as a white-to-green color gradient, with darker green representing areas where more passes were taken.

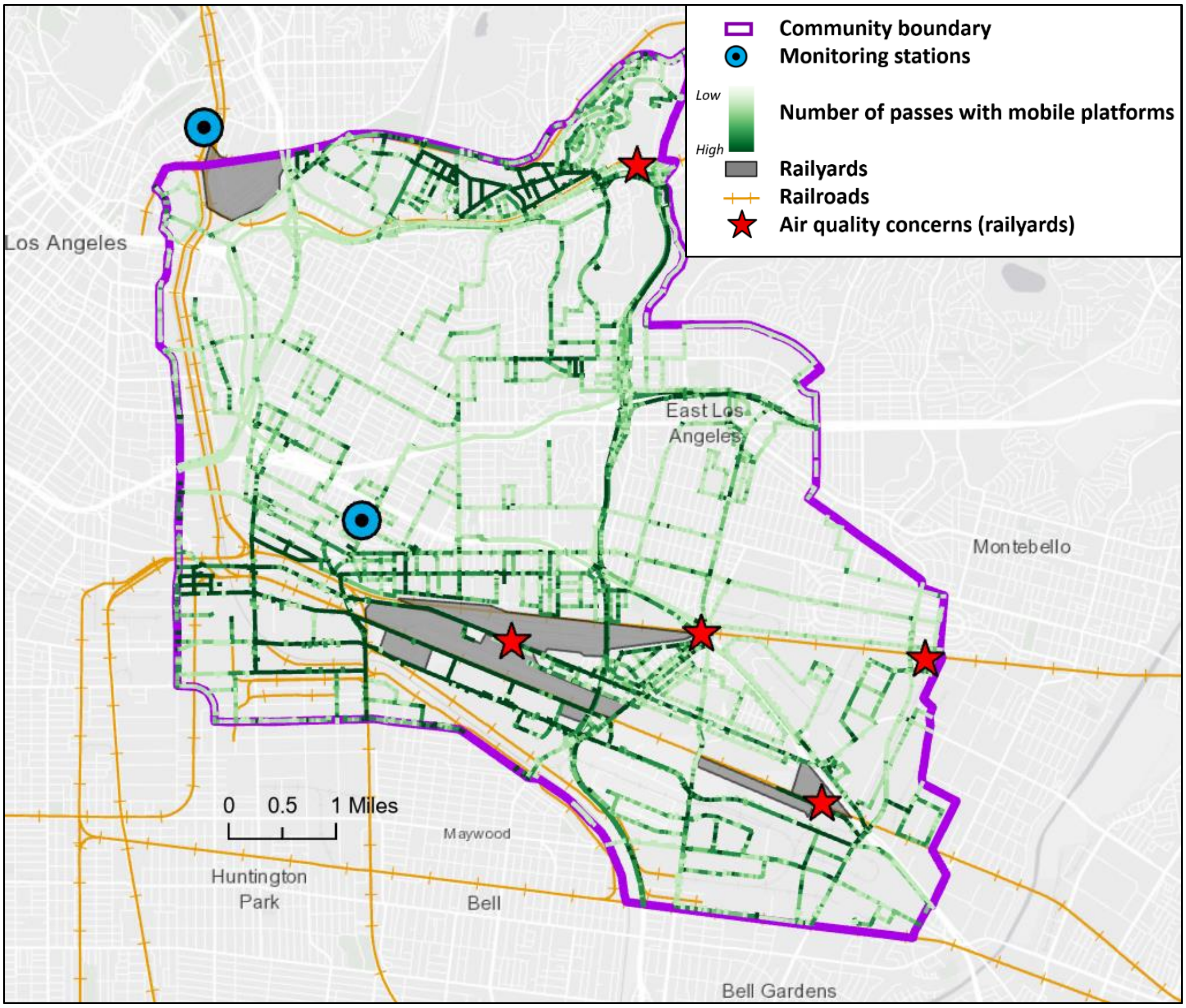

Figure A-1. The routes traversed by the mobile platform around the railyards as well as within nearby neighborhoods. A total of 6 days of mobile monitoring was conducted around the railyards and nearby neighborhoods within the ELABHWC community, as well as the location of air monitoring stations for baseline measurements

Figure A-2 shows the duration and time window for the area-wide mobile measurements performed within the ELABHWC community and near the railyards. As shown in this figure, mobile monitoring was performed in different times of the day during the six survey days. The starting time of the mobile monitoring surveys varied between 7:30 and 11:30 am PST (Pacific Standard Time), whereas the ending time ranged from 11:30 am to 4 pm PST.

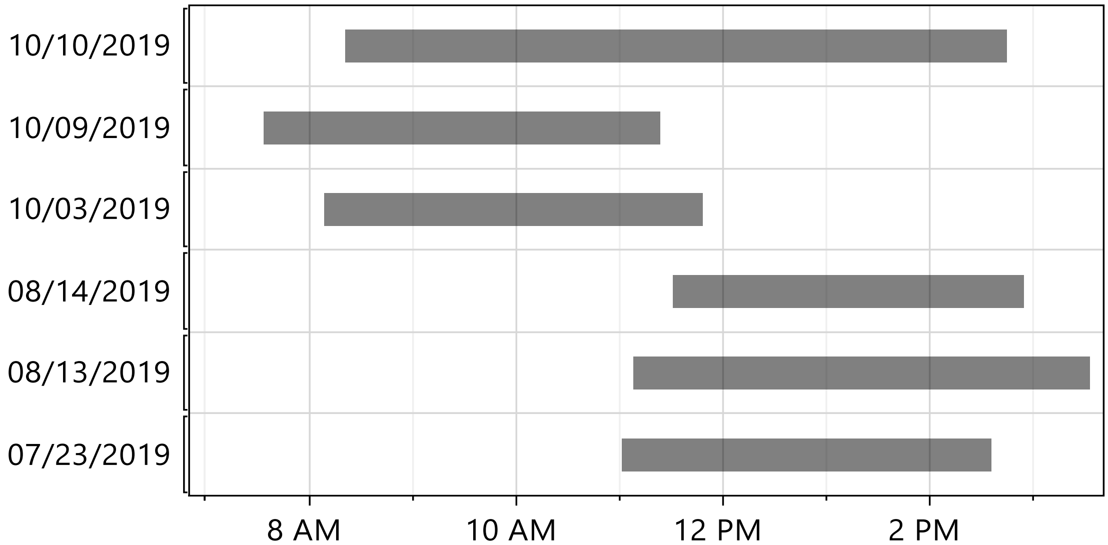

Figure A-2. The duration and time window for the area-wide mobile measurements performed within the ELABHWC community and around the railyards. The time windows only include hours of active mobile measurements within the community, excluding the commute time between the South Coast AQMD Headquarters and the ELABHWC community

Upon extensive screening and pre-processing of the data, NO_2 measurements were found to be the most robust and reliable set of diesel exhaust markers data measured, with 6 (out of 6) valid days of measurements and minimum instrument down time, followed by UFP and BC measurements, with 3 valid days of measurements, respectively. Figures A-3, A-4, and A-5 illustrate "aggregated" maps of the spatial pattern (or concentration gradient) of NO_2, UFP, and BC concentrations within the ELABHWC community and around the railyards, as measured by the mobile monitoring platform during those five days. To ensure that the concentration gradient map is representative of the variations in the pollutant concentrations, individual measurements taken within a 50-meter radius in different passes and on different days were "aggregated", by calculating their arithmetic average, and shown as colored hexagonal bins on the map. Therefore, each hexagon on the map represents multiple measurements taken at different passes. In addition, it should be noted that mobile measurements taken on different days and hours cannot be directly compared, mainly because of the day-by-day and diurnal (i.e., hour-of-the-day) variability in pollutant concentrations as a result of changes in meteorology and source emissions strengths. Therefore, in order to account for the day-by-day as well as diurnal variability in the pollutant concentrations, the mobile monitoring data need to be normalized with stationary data from a fixed site monitoring station, according to a commonly used method in the literature. To achieve this, minutely data from the Resurrection Church monitoring station was collected and hourly averages of pollutant concentrations were computed for the time period corresponding to the mobile monitoring period (Figure A-2). For example, on October 3rd, 2019, mobile monitoring was performed from 8 am PST to 12 pm PST, therefore, a total of 4 hourly averages were calculated for each pollutant from the Resurrection Church monitoring station. Subsequently, the mobile monitoring data with 1-second time resolution was divided by the hourly averaged stationary data that corresponded to the hour in which that measurement was taken. It should also be noted that for a few hours on some of the mobile measurement days, data from the Resurrection Church monitoring station were not available; on these occasions, data from the next closest monitoring station (i.e., Central Los Angeles (CELA) Monitoring Station) was used instead for day-by-day and hour-of-the-day correction. It is noteworthy that CELA monitoring station is just outside of the ELABHWC boundary and very close to the Union Pacific Railroad Los Angeles Transportation Center (UP LATC) Railyard located to the northwest of the community.

Monitoring results indicated somewhat elevated concentrations of NO_2 near and downwind of the railyards within the ELABHWC community, but as shown in Figure A-3, these elevations were not as significant as those observed on major streets and freeways. As shown in the map, most elevated NO_2 concentrations were observed on freeways and freeway off-ramps, including transects of the I-710, I-5, and 60, as well as major roadways, including Bandini Blvd., Washington Blvd., Santa Fe Ave., and Soto St. It can also be observed from the map that NO_2 concentrations were relatively lower in residential communities as compared to those near railyards and on major streets and freeways. It should be noted that NO_2 (and the other diesel emission tracers measured) are emitted from multiple sources. This includes trains with diesel engines, diesel trucks, off-road diesel equipment, and other diesel engines. Therefore, inferences cannot be made (at least with a high level of certainty) on how much of the levels measured using the mobile platform is attributed to each source. Nonetheless, near-source measurements are performed in close proximity to or within the source (e.g., measurements inside freeways, or right downwind of railyards) and are likely to be mostly impacted by the source in their vicinity, providing a qualitative measure to compare potential contributions of each emission source to the ambient levels. The more accurate quantitative evaluation of source contributions would require proper source apportionment studies.

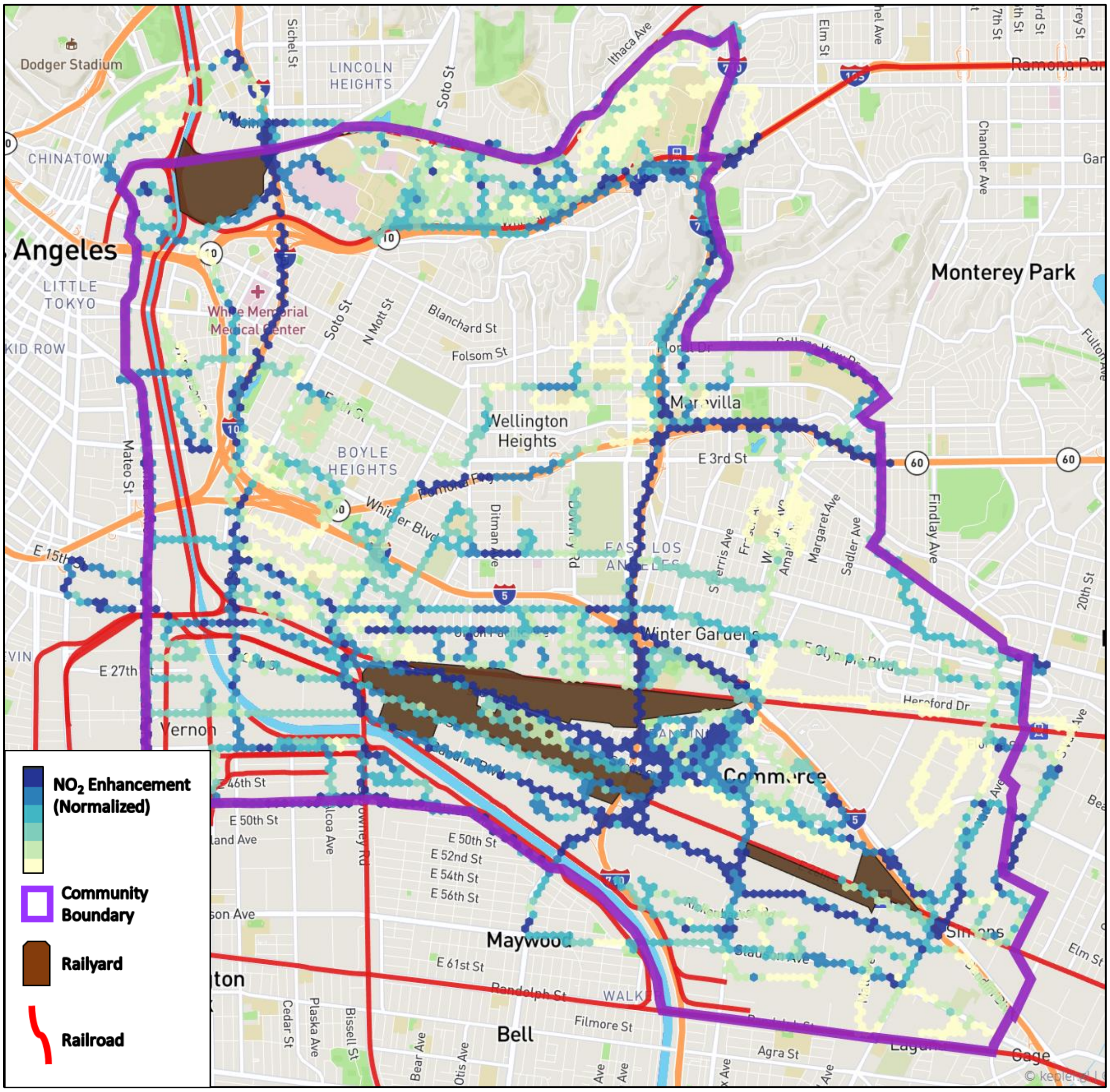

Figure A-3. Aggregated map of the spatial pattern of NO_2 concentrations within the ELABHWC community and around the railyards, as measured by the mobile monitoring platform on 07/23/2019, 08/13/2019, 08/14/2019, 10/03/2019, 10/09/2019, and 10/10/2019

UFP concentrations were elevated near the railyards within the ELABHWC community (Figure A-4). However, these elevated levels were lower than concentrations observed on the I-710, I-10, and 60 freeways, or on some of the major roadways such as Santa Fe Ave. and Soto St. Similarly, to NO_2, UFP concentrations were generally lower in residential communities as compared to those measured near railyards and on major streets and freeways within ELABHWC.

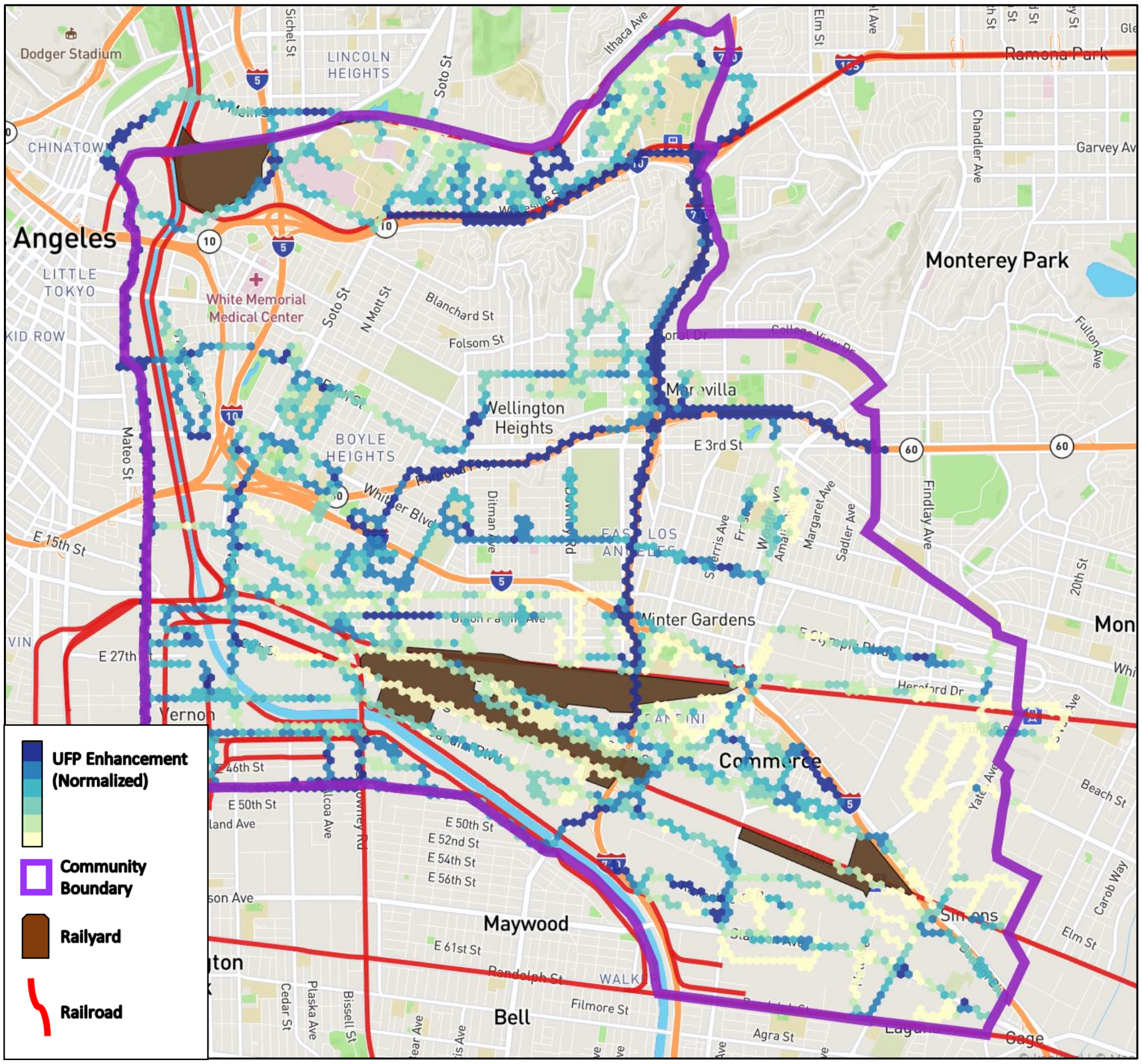

Figure A-4. Aggregated map of the spatial pattern of UFP concentrations within the ELABHWC community and around the railyards, as measured by the mobile monitoring platform on 10/03/2019, 10/09/2019, and 10/10/2019

As shown in Figure A-5, BC concentrations also showed the highest elevations on freeways (e.g., I-710 and 60 freeways) and major roadways (e.g., Bandini Blvd., Washington Blvd., Soto St., Santa Fe Ave). We also observed somewhat elevated BC levels near/downwind of the railyards within the ELABHWC community, but these elevations were not as significant as those observed on major streets and freeways.

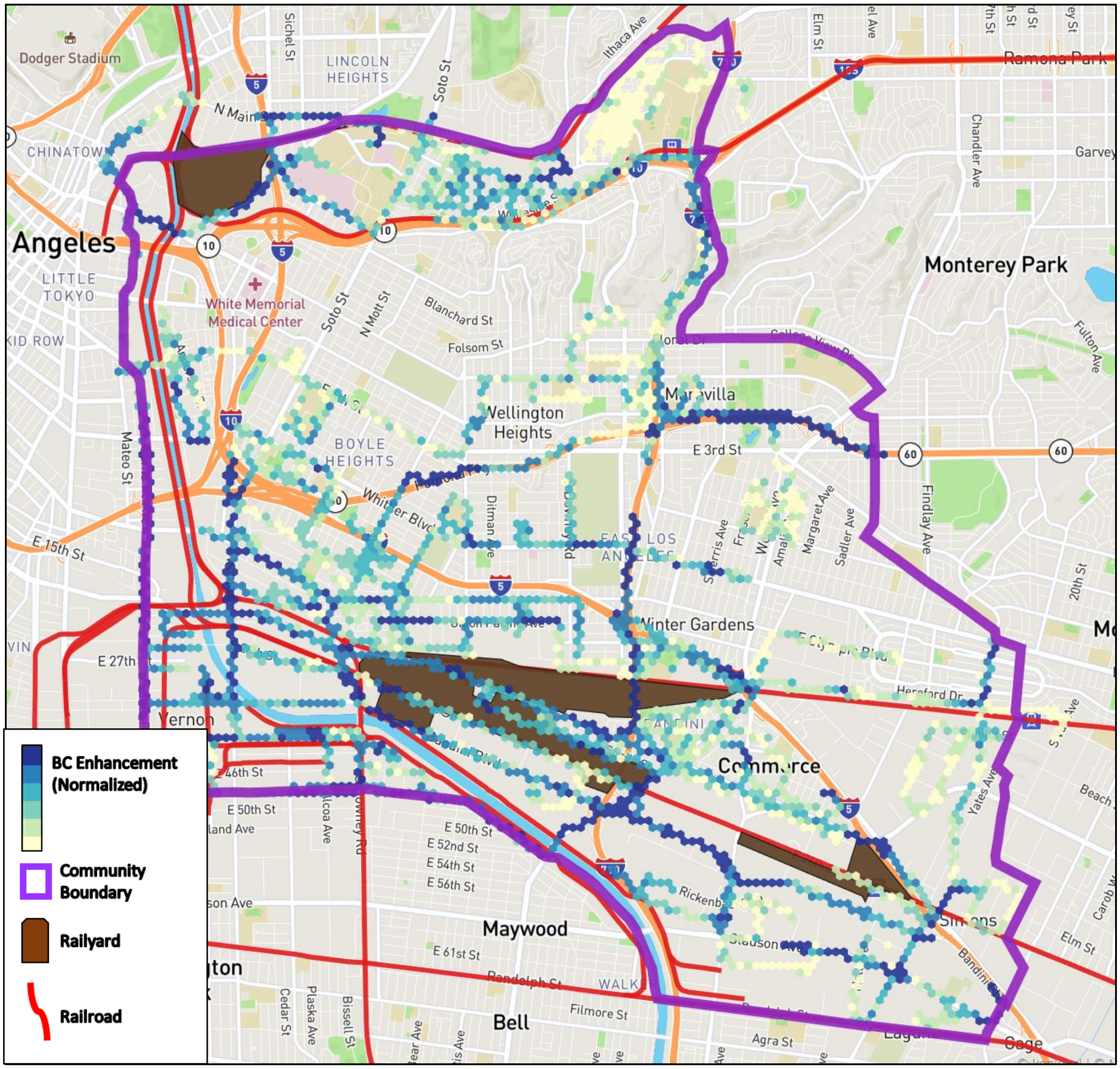

Figure A-5. Aggregated map of the spatial pattern of BC concentrations within the ELABHWC community and around the railyards, as measured by the mobile monitoring platform on 10/03/2019, 10/09/2019, and 10/10/2019