Action: Air Monitoring Near Auto Body Shops

Background & Objective

The community steering committee (CSC) identified emissions from a number of auto body shops along specific corridors and main streets in the East Los Angeles, Boyle Heights, West Commerce (ELABHWC) community as an air quality priority. Additionally, based on the South Coast AQMD Facility Information Detail (FIND) database, there are 16 auto body shops with spray booth permits in this community. The locations of all these auto body shops are shown in Figure 1.

Automotive refinishing performed in auto body shops, includes the use of paints or coatings that may emit toxic air contaminants. Auto body paint and repair shops can be sources of lead, odors, and volatile organic compounds (VOCs). Moreover, sanding and grinding operations at auto body shops can result in emissions of metal compounds, including chromium (Cr) and nickel (Ni), in the form of fine dust. The dust containing metal compounds can accumulate over time and re-suspend as a result of human activity and wind, leading to fugitive emissions of toxic metals.

To address this priority, the CSC identified actions including mobile monitoring near and around auto body shops, followed by investigations and/or enforcement actions, if persistent elevated air pollution levels are found. This strategy also involves community air monitoring to assess how the emissions from auto body shops contribute to the overall levels of air pollution in ELABHWC.

Method

South Coast AQMD's air monitoring efforts to identify and characterize sources of VOCs and toxic metal emissions in ELABHWC begun with a systematic identification and prioritization of potential sources of VOCs and metals emissions. This was followed by air monitoring using advanced technology to confirm the presence and impact of specific emission sources.

Baseline measurements have been taken to provide information about general air toxic metals levels in this community and track the progress of emission reduction strategies over time. South Coast AQMD conducts routine ambient air monitoring and sampling at the Central Los Angeles Air Monitoring Station, just outside of ELABHWC community border, (Figure 1) to measure various air pollutants including air toxic metals and satisfy state and federal air quality requirements (see Attachment A and B for details). In addition, a new air monitoring station was established under the AB 617 program at Resurrection Church in Boyle Heights (Figure 1) to conduct baseline air toxic metals measurements using both time-integrated and continuous monitoring methods (See Attachment A for details).

In addition to the time-integrated sampling, South Coast AQMD utilizes continuous VOCs and multi-metals monitors either at a fixed location or inside a mobile platform to identify pertinent hotspots or measure concentrations of a specific list of VOCs and metal compounds near the source. In addition, South Coast AQMD partnered with Aerodyne Research LLC. to evaluate continuous VOCs and multi-metal monitors for mobile measurement applications and identify air toxic metals and VOCs hotspots in ELABHWC (see Attachments B and C for details). These mobile surveys help identify facilities that may contribute to the air quality issues experienced in this community. This may lead to facility inspections and/or enforcement actions, when appropriate.

Results

- Baseline measurements, carried out between July and December 2019, indicated that the levels of particulate metals at the Central Los Angeles and Resurrection Church air monitoring sites were within the typical ranges measured elsewhere in the South Coast Air Basin (see Attachment A for details)
- Elevated concentrations of several metals were observed near some clusters of auto body shops, especially those located to the north of the ELABHWC community, and those near E Washington Blvd., E Olympic Blvd., 3rd St., and E Beverly Blvd.
- Elevated metal concentrations were also observed on major streets and freeways, including the I-710 freeway, Bandini Blvd., E Washington Blvd., and S Soto St.
- Except for Ni, all other measurements for the species evaluated in this report were below the pertinent acute RELs. Even in case of Ni, there was only one outlier that exceeded the acute REL of 200 ng/m^3. This high level was observed near a cluster of auto body shops and metal processing facilities located to the north of the community)

Next steps

- Continue baseline monitoring at the Central Los Angeles and Resurrection Church air monitoring stations
- Conduct follow-up mobile monitoring in areas where elevated levels of metals were observed in previous mobile measurements
- Continue mobile monitoring and analysis of data to quantify the levels of VOCs and metals around auto body shops of concern and identify any other unknown emission sources
- The mobile monitoring conducted by Aerodyne was a proof -of-concept project which resulted in South Coast AQMD developing a mobile laboratory for measuring VOCs and odorous compounds and an additional mobile platform for metals monitoring. This added capability will allow South Coast AQMD to conduct VOC and multi-metal measurements in-house. Both mobile platforms are currently under development and will be ready for deployment in the first half of 2021

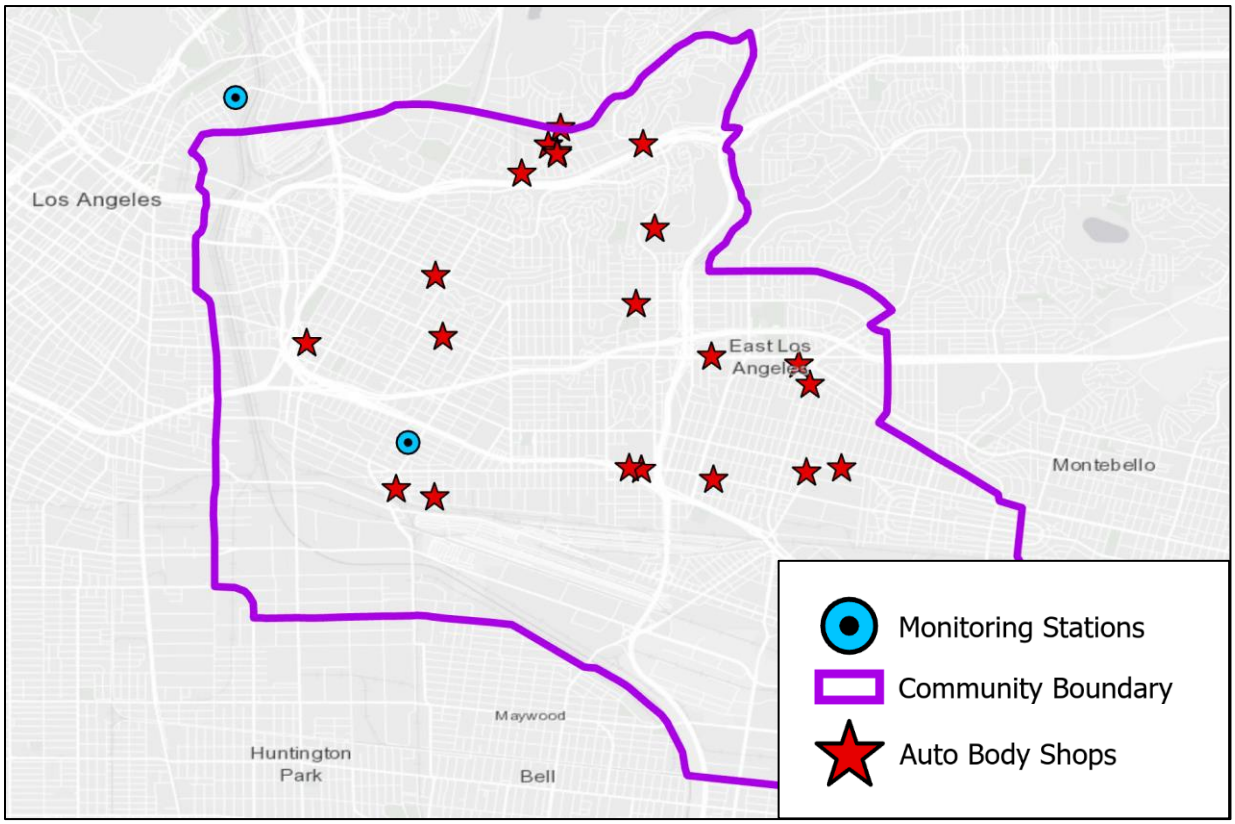

Figure 1. Map showing the locations of 21 auto body shops within the ELABHWC community, and the location of air monitoring stations for baseline measurements. Five of these facilities were identified by the CSC, while 16 additional auto-body shops with spray booths permits were identified based on the South Coast AQMD FIND database

Attachment A

Baseline multi-metals monitoring

The South Coast AQMD conducts ambient air monitoring to measure criteria air pollutants for state and federal air quality requirements at Central Los Angeles Air Monitoring Station (just outside of ELABHWC community border), including long-term one-in-six days 24-hours time-integrated measurements of particulate metals (Figure 1). In addition, a new air monitoring station was established under the AB 617 program at Resurrection Church in Boyle Heights (Figure 1) to conduct baseline metals monitoring including one-in-twelve days 24-hours time-integrated monitoring. A summary of metals' concentrations measured at Central Los Angeles (CELA) and Resurrection Church sites between July and December 2019 are presented in Figure A-1. At CELA, the following species in total suspected particles (TSP) are reported: Hexavalent Chromium, Lead, Beryllium, Copper, Cadmium, and Manganese. To provide context to the levels of metals measured at these two sites, concentrations were compared with those measured during the fourth Multiple Air Toxics Exposure Study[1] (MATES IV) at 10 sites throughout the South Coast Air Basin between 2012 and 2013. The MATES IV study provides a regional estimate of the background or typical ambient levels of air toxics in 10 locations throughout the region.

[1] https://www.aqmd.gov/home/air-quality/air-quality-studies/health-studies/mates-iv

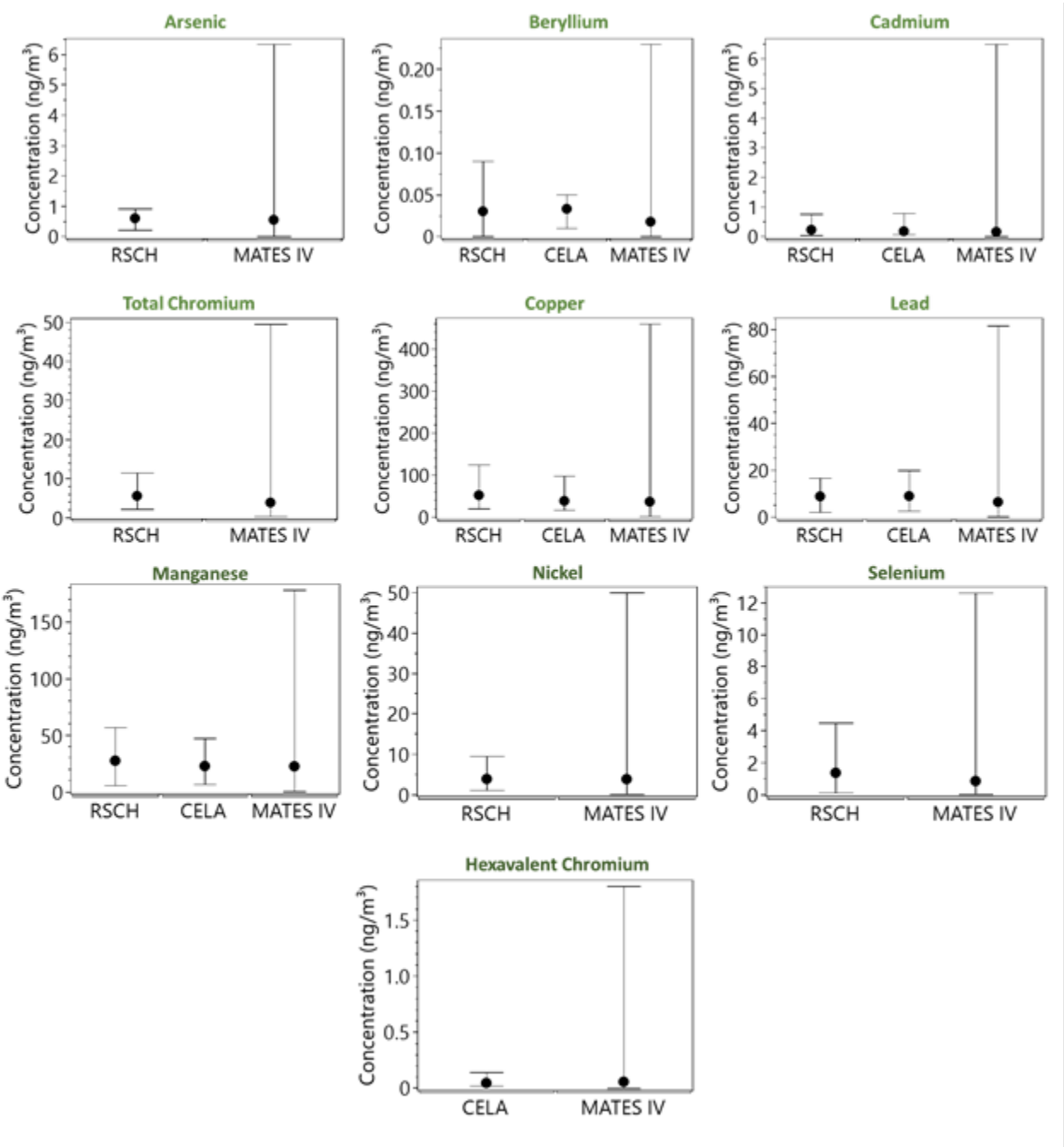

Figure A-1. Concentrations of metals in total suspended particles (TSP) measured at Central Los Angeles (CELA) site, where applicable and Resurrection Church (RSCH) site along with a comparison with levels measured during MATES IV. Black dots are average concentrations and error bars show the range (minimum and maximum) of variation

Measurement of air toxics has conventionally been carried out by collecting 24-hour time integrated samples (e.g., filter samples for particulate and canisters for gaseous air toxics) at limited and sparsely distributed fixed air monitoring sites followed by subsequent analysis in the laboratory. While this method is suitable for regulatory and compliance monitoring purposes, it is labor intensive, time consuming, and has poor temporal and spatial resolution. This results in limited information on the diurnal variations, community-scale spatial distribution, and maximum concentrations of these air toxics. Given the large spatial variability of air toxic concentrations, there is a great need for spatially resolved data to: identify major sources of air toxics emissions and pollution hotspots in communities; evaluate the impact of emission sources on the communities through community-scale monitoring; quantify the contribution of different emission sources through source apportionment studies; and support the development of policies and emission reduction strategies designed to protect public health of citizens. As can be seen in Figure A-1, concentrations of all metals measured between July and December 2019 at Central Los Angeles and Resurrection Church air monitoring stations are well within the ranges measured elsewhere in the region, considered as typical ambient levels.

In addition to the 24-hr time-integrated monitoring, South Coast AQMD started utilizing continuous and highly time-resolved (i.e., 1-hour time resolution) multi-metals monitoring to measure concentrations of multiple particulate metals, simultaneously. This approach has been used by the South Coast AQMD in applications, such as identifying facilities or areas with elevated ambient concentrations that may require further investigations. Cooper Environmental Services, LLC (Cooper) is a vendor of multi-metals monitoring technology with monitors that utilize x-ray fluorescence (XRF) to determine concentrations of a specific list of metal compounds including K (Potassium), Ca (Calcium), Ti (Titanium), V (Vanadium), Cr (Chromium), Mn (Manganese), Fe (Iron), Co (Cobalt), Ni (Nickel), Cu (Copper), Zn (Zinc), As (Arsenic), Se (Selenium), Ag (Silver), Cd (Cadmium), Sn (Tin), Sb (Antimony), Ba (Barium), Hg (Mercury), Tl (Thallium), and Pb (Lead).

The performance of the Cooper Environmental Services Xact 625 monitors have been fully evaluated by the South Coast AQMD and they have been used to determine compliance with Rule 1402 Risk Reduction Plan[2] for a facility and has assisted in source identification by correlating metals concentrations to wind speed and direction. The performance of this continuous ambient air monitoring system has also been evaluated by U.S. EPA through its Environmental Technology Verification Program[3]. The report concluded that that the daily average Xact 625 results were highly correlated and in close quantitative agreement with the reference inductively coupled plasma mass spectrometry (ICP-MS) analysis results for most of the six metals analyzed (calcium, copper, manganese, lead, selenium, and zinc), and that the Xact 625 achieved data completeness of over 95%. South Coast AQMD installed a continuous multi-metals monitor (Xact 625) at the Resurrection Church site in March 2020 and have been measuring concentrations of several

[2] Rule 1402 Control of Toxic Air Contaminants from Existing Sources: http://www.aqmd.gov/docs/default-source/rule-book/reg-xiv/rule-1402.pdf

[3] Cooper Environmental Services LLC. Xact 625 Particulate Metals Monitor. Kelly, T., Dindal, A., & McKernan, J., Columbus, OH: U.S. Environmental Protection Agency. September 2012.

metals with hourly time resolution. The data from this monitor can be accessed through the online data display tool[4].

One of the advantages of highly time-resolved measurement of air pollutants is to measure emission sources with rapid temporality or evaluate the impact of exceptional, short-term events on local air quality. One of the special events that is known to impact local air quality, particularly for metal species, is the local and regional firework displays on 4th of July. The continuous multi-metals monitor at Resurrection Church measured substantially higher concentrations of several metals (potassium, barium, copper, etc.) during the 2020 4th of July fireworks. More information can be found in an interactive infographic published on South Coast AQMD's website[5].

[4] http://xappprod.aqmd.gov/AB617CommunityAirMonitoring/Home/Index
[5] http://www.aqmd.gov/home/air-quality/air-quality-studies/special-monitoring/independence-day-fireworks

Attachment B

Multi-Metals Mobile Monitoring

The South Coast AQMD has been developing and evaluating the most advanced air monitoring technologies and methods to enhance its capability to investigate air toxic emissions in the South Coast Air Basin. One of the strategies employed by the South Coast AQMD to capture the spatial variability of air pollutants and identify the major emission sources within communities involves the deployment of high time resolution air monitors on mobile platforms. This provides an effective methodology to survey vast areas in a relatively short period of time. The ability of the mobile platforms to drive in and around a community and follow emission plumes as they are transported through the neighborhood by wind, can be critical for pollution hotspot and emission source identification. To date, mobile monitoring has been most extensively used for capturing the spatial variations of criteria air pollutants (i.e., PM, CO, NO_2, etc.), and less attempt has been made to develop platforms for mobile monitoring of air toxics, especially ambient particulate metals. South Coast AQMD partnered with Aerodyne Research LLC and Cooper Environmental LLC to evaluate the suitability of the continuous multi-metals monitor in mobile applications. A Xact 625i monitor (a newer version of the Xact 625 that is operating at Resurrection Church Air Monitoring Station) was installed in a specialized mobile laboratory and used to identify air toxic metals hotspots and pinpoint areas for further investigation or placement of fixed monitoring sites. The Xact 625i monitor is capable of measuring over 20 metals at 5-minute resolution and South Coast AQMD collaborated with the Cooper Environmental Services LLC to perform optimizations and modifications to the instrument for mobile measurement applications.

During the evaluation, nine (9) days of mobile surveys were conducted in the East Los Angeles, Boyle Heights, West Commerce (ELABHWC) community in June and November 2019 with Xact 625i aboard Aerodyne's mobile laboratory. Special focus was given to areas with a high density of potential sources, including the auto body shops. The locations of auto body shops within the ELABHWC community are shown in Figure 1.

In this attachment, we present "aggregated" maps of the spatial pattern (or concentration gradient) of important metals and elements around the auto body shops that are located within the ELABHWC community, as measured by the mobile monitoring platform during those nine days. To ensure that the concentration gradient map is representative of the variations in the metal 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. It is noteworthy that the aggregated maps for 6 important metals, including Cadmium (Cd), Nickel (Ni), Selenium (Se), Chromium (Cr), Vanadium (V), and Aluminum (Al) are presented in this report. The first three metals (i.e., Cd, Ni, and Se) are selected because they are categorized by the United States Environmental Protection Agency (USEPA) as Hazardous Air Pollutants (HAPs), or air toxics. Cr, V, and Al were also selected

because they were found to be associated with industrial emissions, according to the results of a preliminary source apportionment study on multi-metal mobile monitoring data.

Figures B-1 to B-6 illustrate aggregated maps of the spatial variations of these important metals, with respect to the location of auto body shops within the ELABHWC community. Since metal-processing facilities are an important source of these metals, the locations of these facilities within the ELABHWC community are overlaid on the aggregated maps as well. As can be seen in these maps, even though there were some differences in the spatial variations of these important metals, the overall spatial patterns are quite consistent. All the metals show elevated concentrations near auto body shops cluster located to the north of the ELABHWC community (between USC Health Sciences Campus and California State University Campus). Elevated concentrations are also observed near the auto body shops located near E Washington Blvd., E Olympic Blvd., 3rd St., and E Beverly Blvd. It should be noted that these are the locations where with clusters of metal-processing facilities, i.e. another important source of these metals, hence the elevated concentrations cannot be specifically attributed to auto body shops and the pertinent emissions.

In addition to elevated concentrations of metals near auto body shops, relatively high concentrations of these metals were also observed on major streets and freeways, including the I-710 freeway, Bandini Blvd., E Washington Blvd., and S Soto St. This was particularly the case for Ni, Cr, and Cd. This is mainly because these metals have multiple sources, and in addition to industrial sources, such as auto body shops and metal processing facilities, they are also potentially emitted or resuspended in the air by passing traffic. Traffic-related emissions of metals and elements include tailpipe emissions, i.e. emissions directly from the exhaust pipe of the vehicle, and non-tailpipe emissions, which are either generated from non-exhaust traffic-related sources or already exist in the environment as deposited material and become resuspended due to traffic-induced turbulence. The most important abrasion processes which result in direct particulate metals emissions are tire, brake, clutch and road surface wear, with other potential sources being engine wear, abrasion of wheel bearings and corrosion of other vehicle components.

It is noteworthy that mobile monitoring will continue, especially in areas where elevated concentrations of these important metals were observed, to explore whether the elevated levels are persistent.

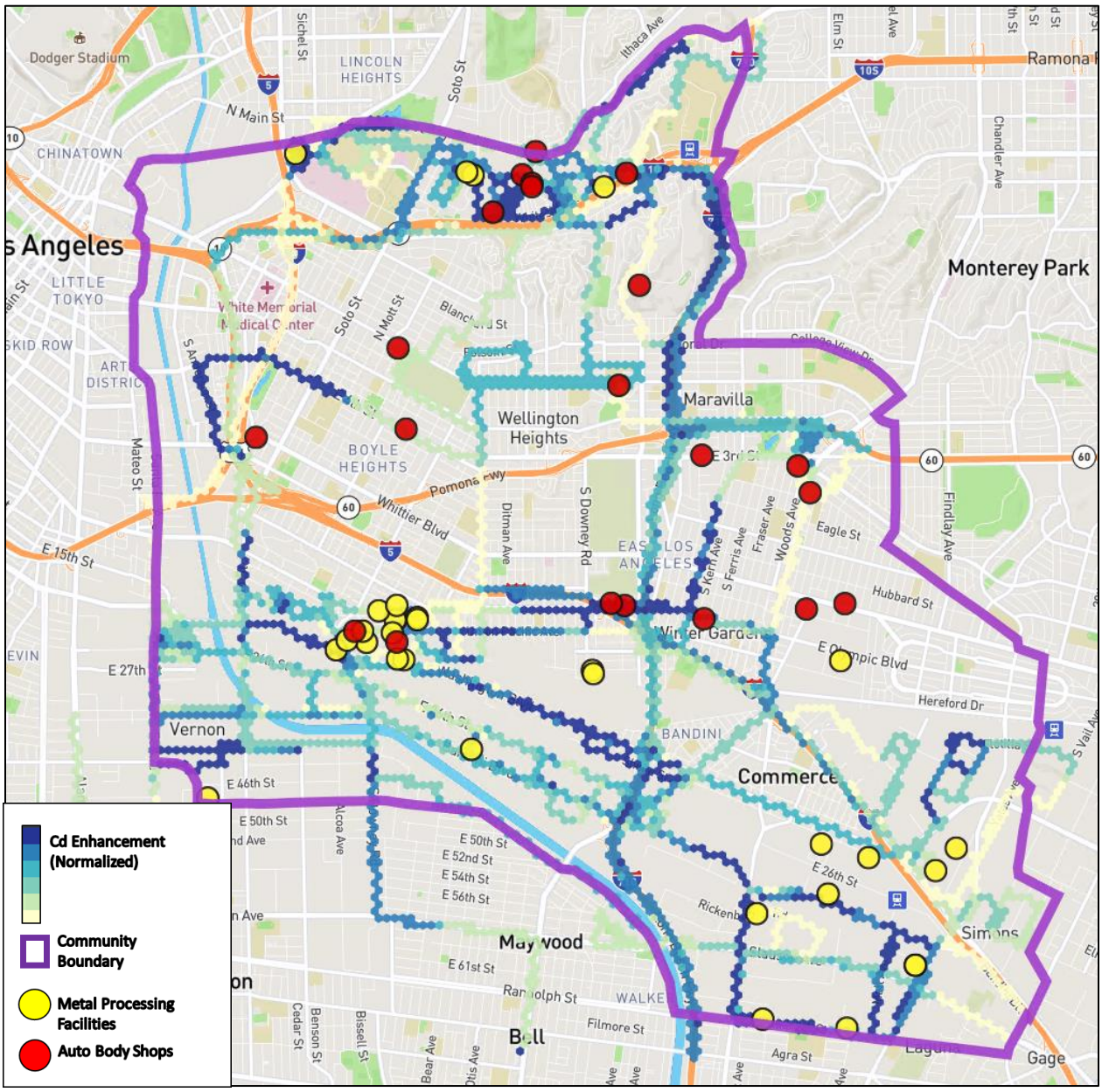

Figure B-1. Aggregated map of the spatial pattern of Cd concentrations around auto body shops and metal-processing facilities within the ELABHWC community, as measured by the mobile monitoring platform

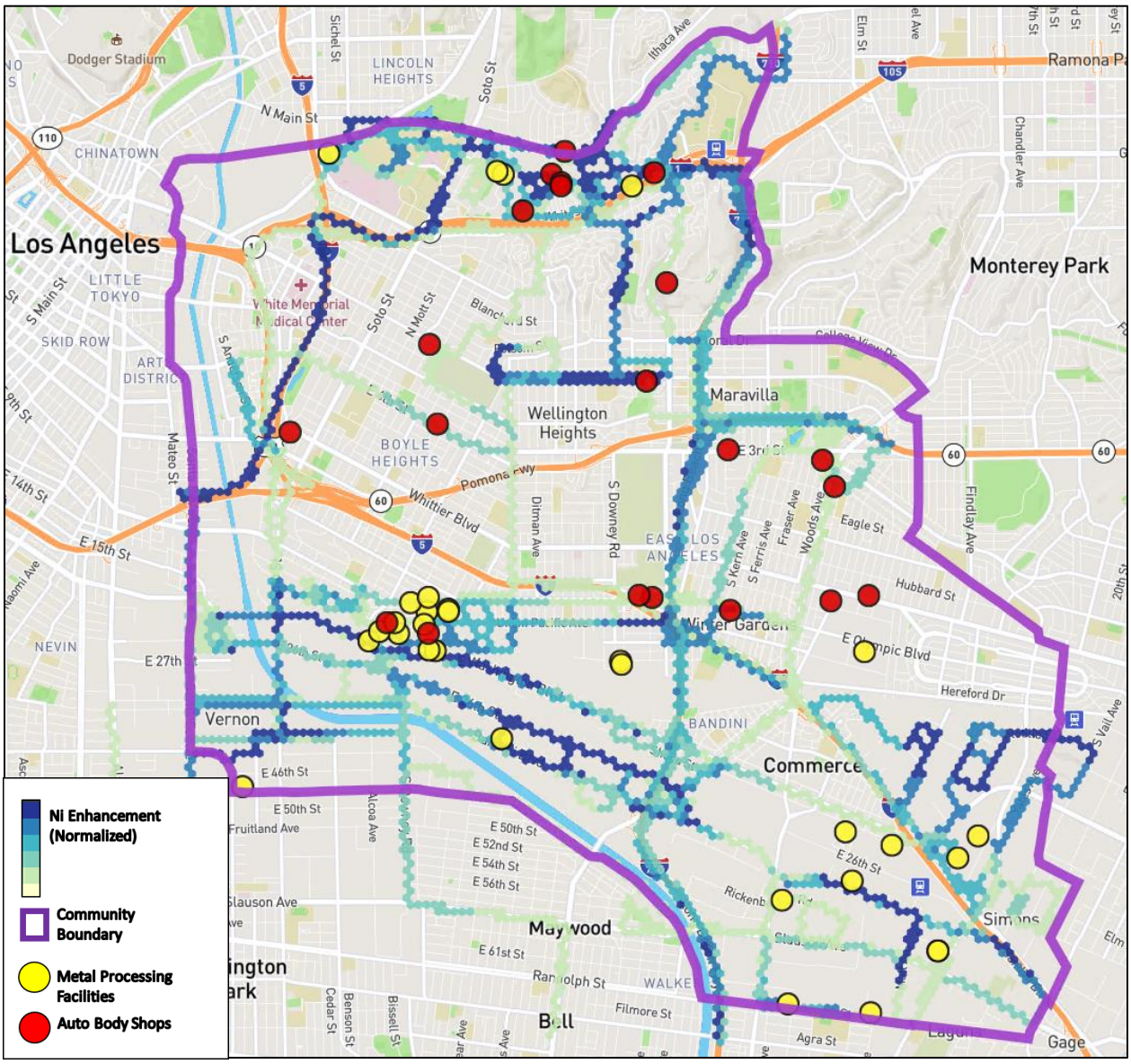

Figure B-2. Aggregated map of the spatial pattern of Ni concentrations around auto body shops and metal-processing facilities within the ELABHWC community, as measured by the mobile monitoring platform

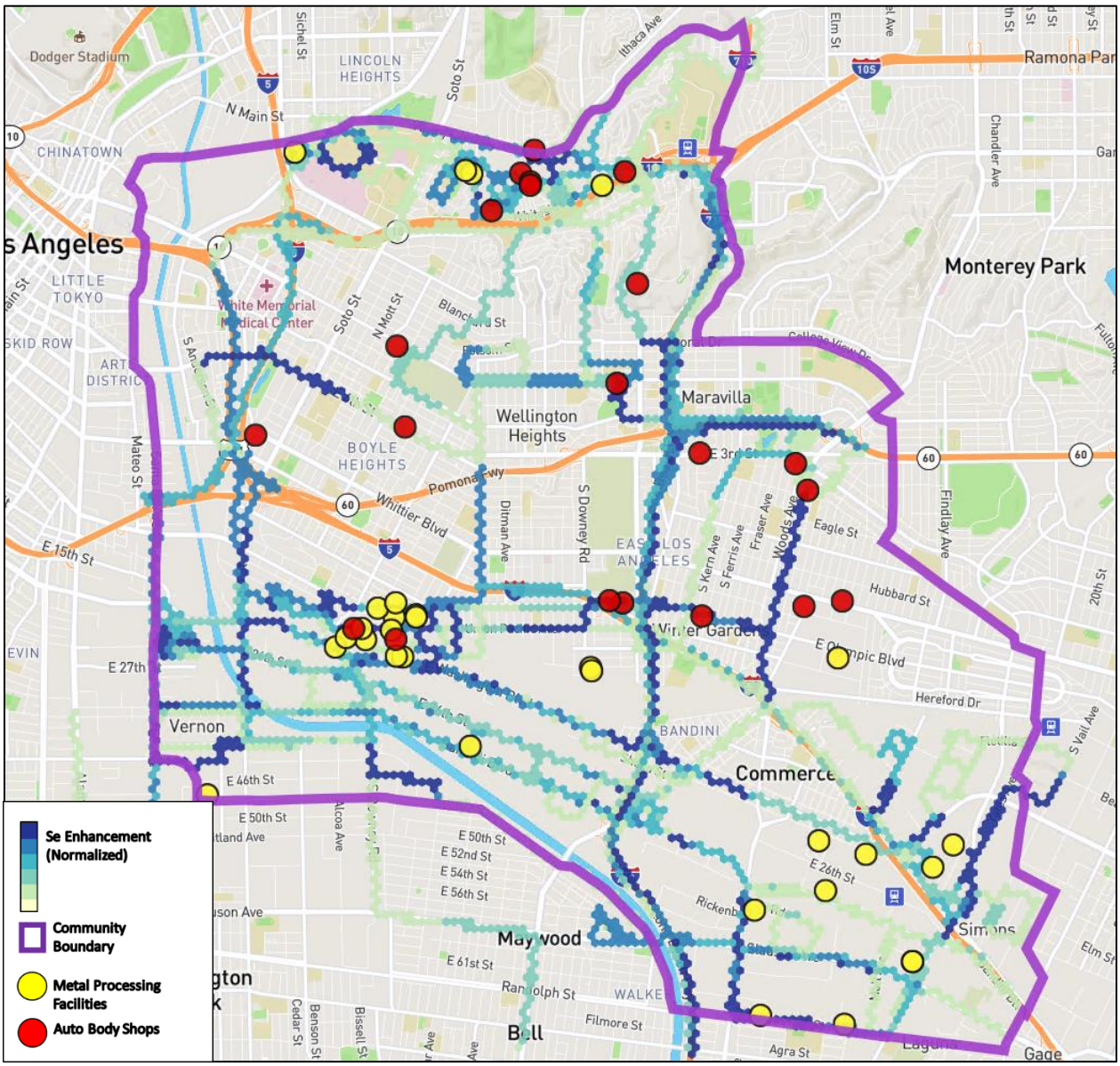

Figure B-3. Aggregated map of the spatial pattern of Se concentrations around auto body shops and metal-processing facilities within the ELABHWC community, as measured by the mobile monitoring platform

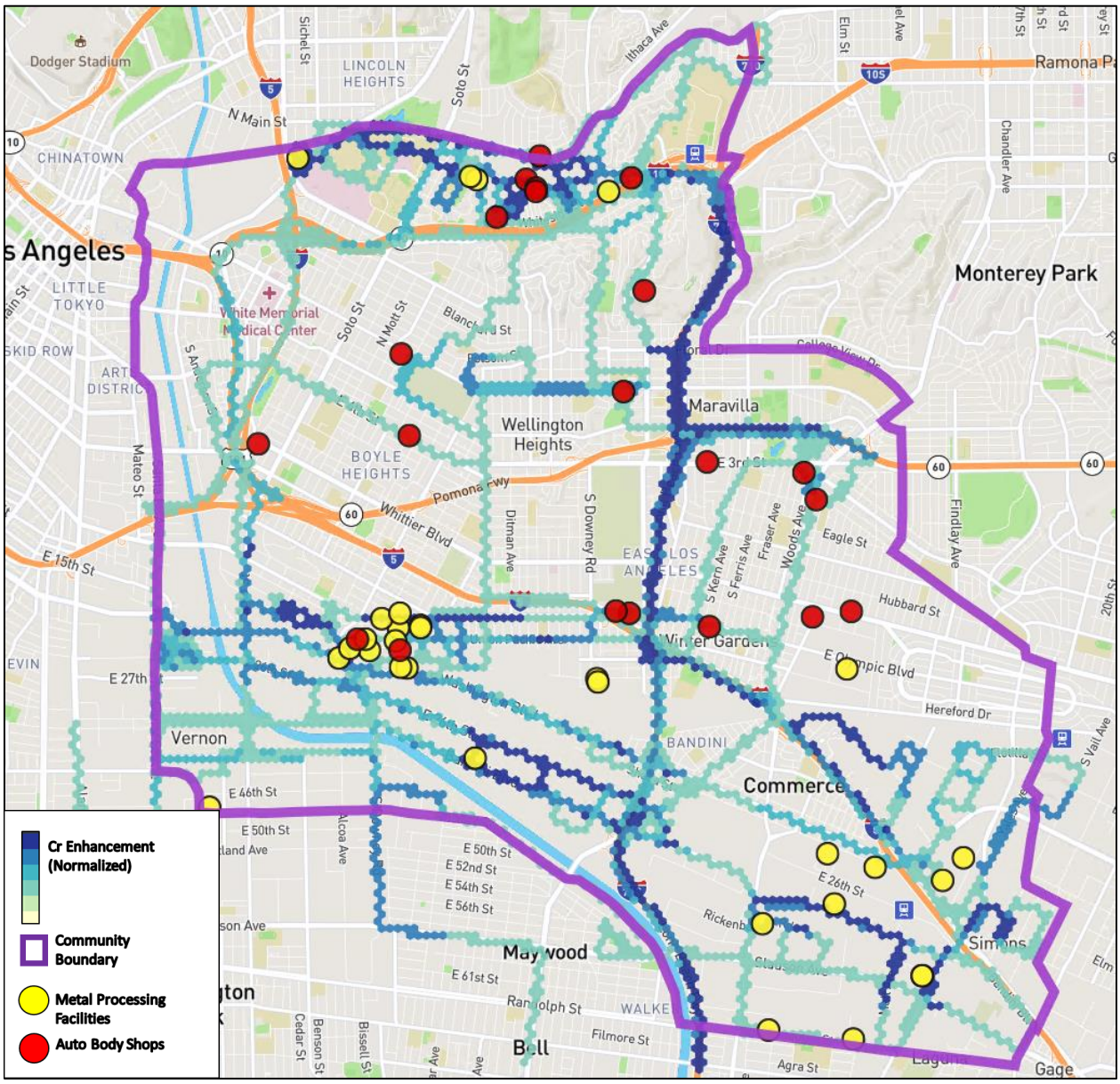

Figure B-4. Aggregated map of the spatial pattern of Cr concentrations around auto body shops and metal-processing facilities within the ELABHWC community, as measured by the mobile monitoring platform

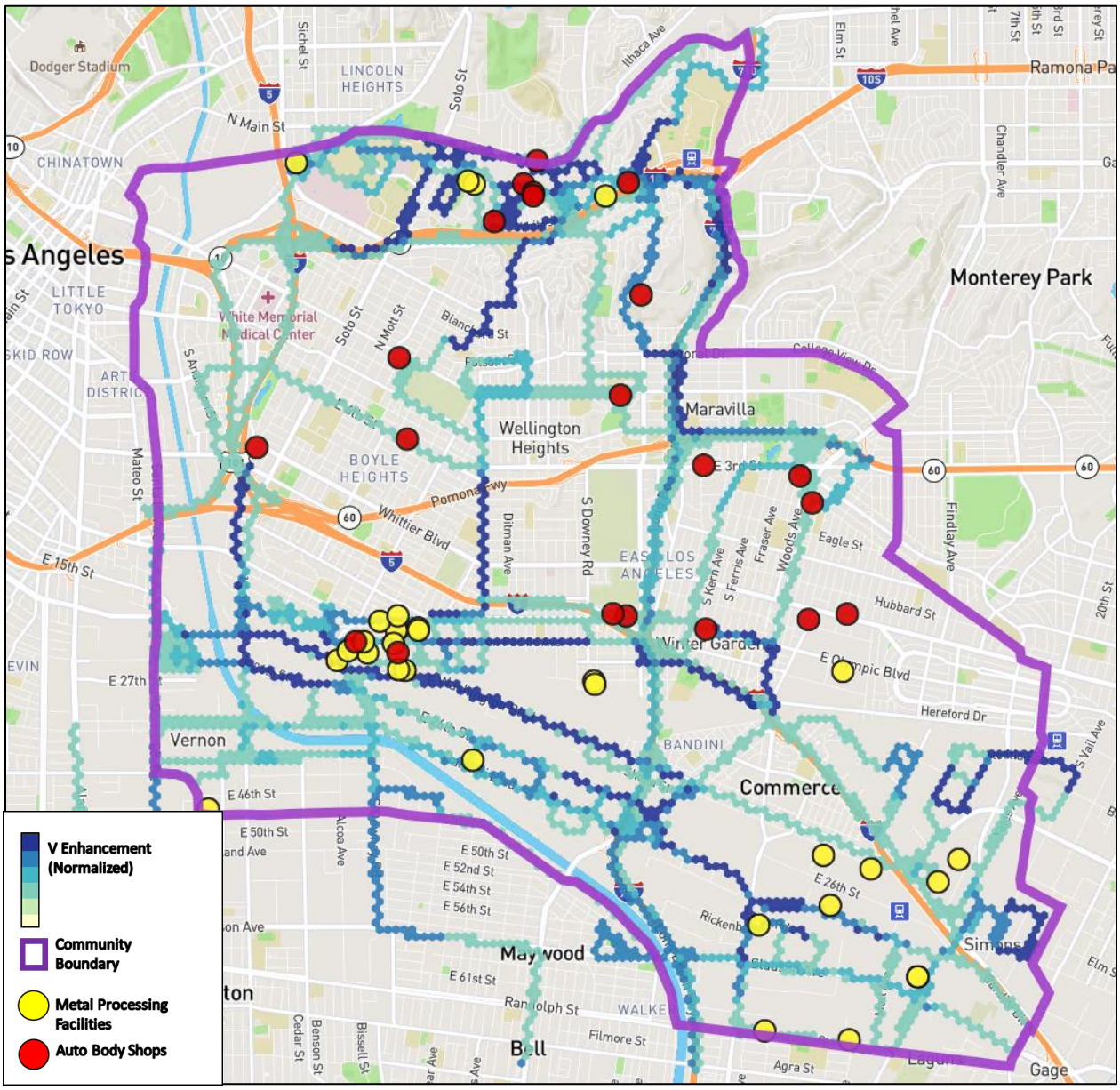

Figure B-5. Aggregated map of the spatial pattern of V concentrations around auto body shops and metal-processing facilities within the ELABHWC community, as measured by the mobile monitoring platform

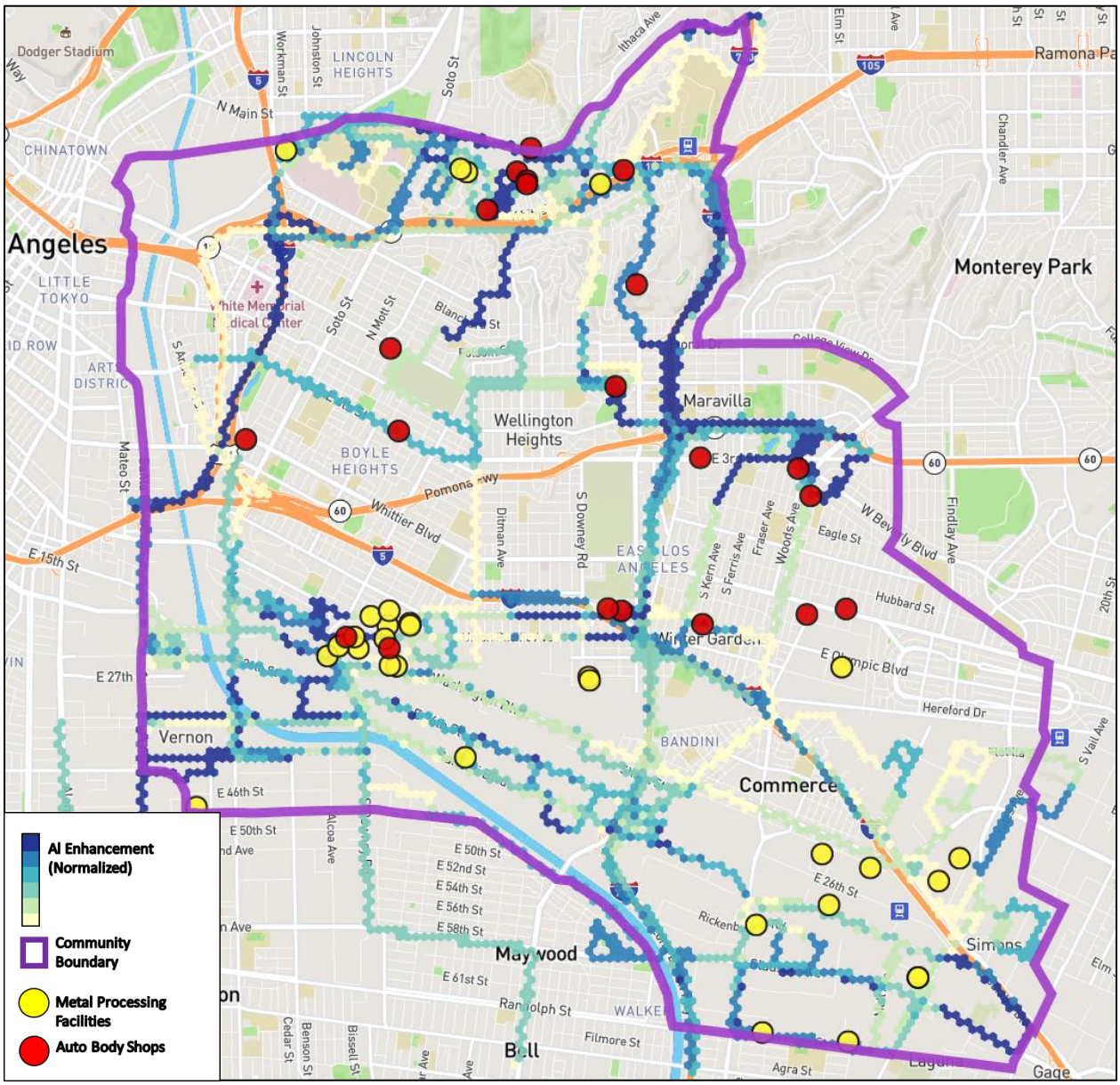

Figure B-6. Aggregated map of the spatial pattern of Al concentrations around auto body shops and metal-processing facilities within the ELABHWC community, as measured by the mobile monitoring platform

To provide context to the levels measured during mobile monitoring, levels were compared to stationary measurements with the same instrument at a fixed site (named MRA) in the city of Paramount between May-Nov 2019 (Figure B-7). It is noteworthy that measurements at MRA had a time resolution of 1-hr, while mobile measurements had a 5-min time resolution. This impacts the detection limit of the instrument and the uncertainties associated with the measurements. In addition, measurements with finer time resolutions (5-min) have larger variations and might indicate higher peaks compared to coarser time resolution data (i.e., 1-hr), mainly because the impact of short-lived elevations in the data are faded during longer sampling times. All these points should be taken into consideration when interpreting the results of this comparison. It should also be noted that in early March 2020, a continuous multi-metals monitor was installed at the Resurrection Church. After the completion of one year of baseline measurements, the data from this site will be used as the basis for comparison with mobile monitoring.

In Figure B-7, for the toxic metals, including As, Cd, Ni, and Se, the acute reference exposure levels (RELs) are provided, wherever applicable. Again, it should be noted that acute RELs are defined based on exposure during an hour while our measurements are in 5-min interval. However, they are only shown (Figure B-7) to provide context as to the levels of metals observed during the mobile monitoring campaign performed in ELABHWC.

As shown in Figure B-7, for all the metals, except for Se and Ni, the mobile measurements indicated higher concentrations than those measured at MRA, most likely because mobile measurements could be performed closer to the source. This could also be attributed partly to the time resolution of the mobile measurements enabling us to look at the short-time variations and peaks it the data (something that is less likely to be captured by 1-hr measurements). With the exception of Ni, all measurements for the species evaluated in this report were also below the pertinent acute RELs. Even in case of Ni, there was only one 5-minute reading that exceeded the acute REL of 200 ng/m^3. This high level was observed near the cluster of auto body shops and metal processing facilities located to the north of the community. South Coast AQMD staff will revisit this area to perform follow-up measurements and evaluate whether the high level observed is persistent.

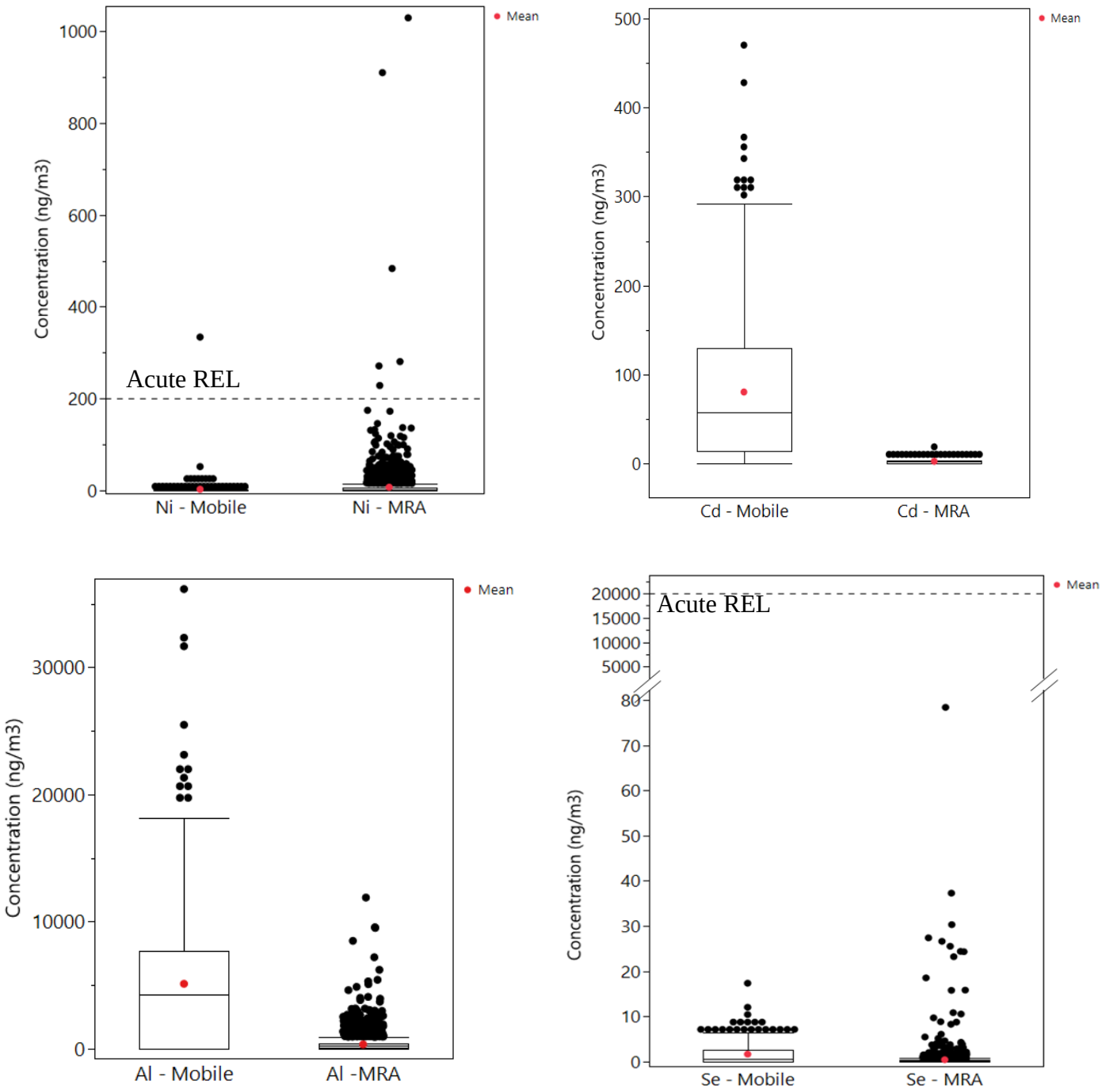

Figure B-7. Box plots of 5-minute mobile metal measurements versus those measured in the city of Paramount (MRA). The boxes represent the 25th and 75th percentiles. The line inside the box represents the median, while the red circle shows arithmetic mean. The whiskers are 1.5 x interquartile range (IQR; the difference between the 75th and 25th percentiles). The solid black circles represent outliers. Acute RELs (based on 1-hour average) are also presented wherever applicable

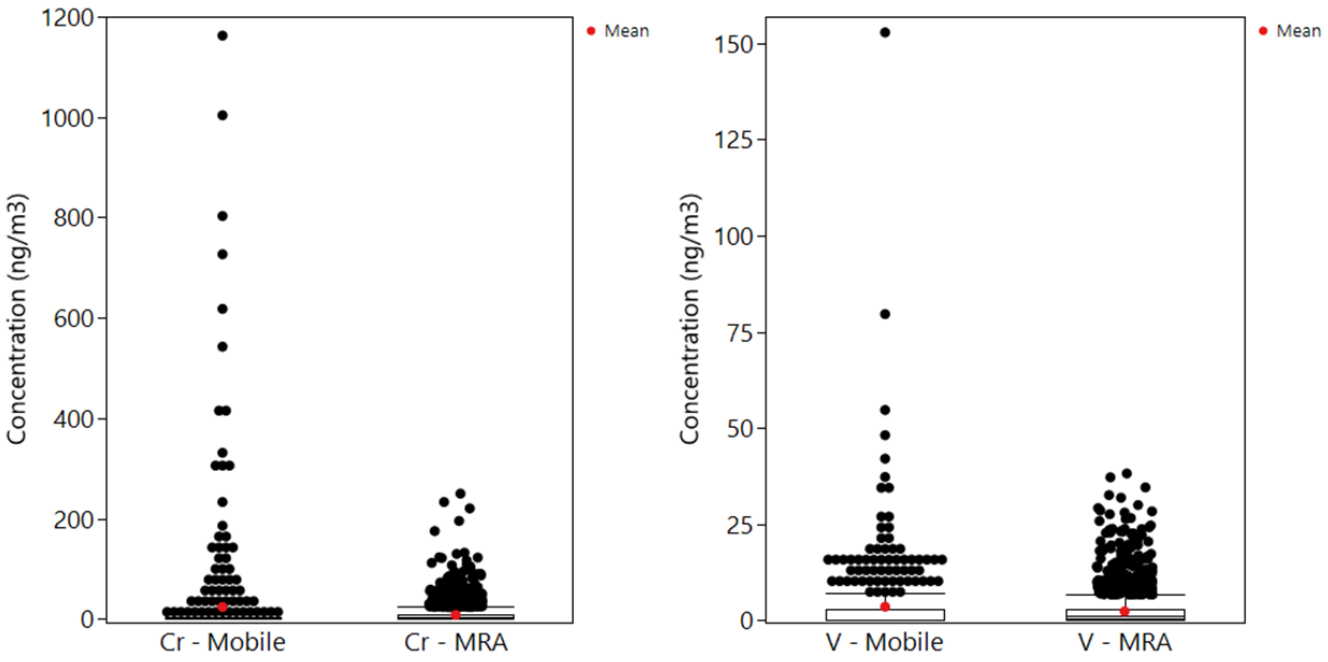

Figure B-7. Continued

Given the promising results achieved through the evaluation of Xact 625i on Aerodyne's mobile platform, the South Coast AQMD began to design and develop its own mobile platform for multi-metals measurement using a modified Xact 625i monitor. In addition to Xact 625i, several other instruments will be added to the mobile platform to measure other relevant air pollutants, including particulate matter (PM) mass, ultrafine particles (UFP), black carbon (BC), nitrogen dioxide (NO_2), and wind speed and direction. Once ready, this mobile platform will be used to conduct extensive community-scale air quality monitoring.

Attachment C

Volatile Organic Compounds (VOCs) Mobile Monitoring

The South Coast AQMD acquired the services of Aerodyne Research LLC to conduct mobile measurements with the state-of-the-art Proton Transfer Reaction – Mass Spectrometry (PTR-MS), which is the benchmark method for simultaneous real-time monitoring of VOCs at very low concentrations. The results of these survey were presented to the Community Steering Committee (CSC). This proof of concept effort has resulted in South Coast AQMD to develop an PTR-MS mobile laboratory in order to conduct these measurements in-house.

As mentioned in Attachment B, during this campaign, nine (9) days of mobile surveys were conducted in the East Los Angeles, Boyle Heights, West Commerce (ELABHWC) community in June and November 2019 with the PTR-MS instrument aboard Aerodyne's mobile laboratory. Special focus was given to areas with a high density of potential sources, including the auto body shops.

The strategy for analyzing VOC data as pertains to auto body shops involves identification of VOC compounds of interest and preparation of concentration gradient maps to explore the spatial variability in relation to the location of auto body shops and other potential sources of pollution. Efforts have also been made to explore the association between VOCs concentrations and distance from auto body shops, to determine which of the VOCs are mostly associated with this source category, or with individual auto body shops. However, given the complex nature of VOCs emissions from auto body shops, and the multitude of sources that contribute to VOCs concentrations in an urban area with a myriad of industrial sources, a comprehensive analysis that leads to meaningful conclusions would require deeper exploration of data.