Action: Mobile and stationary air monitoring near metal processing facilities of potential concern

Background & Objective

The East Los Angeles, Boyle Heights, West Commerce (ELABHWC) community steering committee (CSC) identified exposure to fugitive emissions from metal processing facilities as an air quality priority for this community. Metal processing facilities include a wide variety of operations such as metal finishing (e.g., plating, anodizing, metal spray coating), heat treating, plasma arc cutting, and other operations. These facilities produce parts that are commonly used in the automotive, aerospace, oil and gas, and other industries. Certain operational activities at these facilities can be sources of toxic metal emissions.

Metal air toxics which include arsenic, cadmium, hexavalent chromium, lead, manganese, nickel, and selenium are particle species that can deposit on surfaces and repeatedly entrain into the air as fugitive emissions, increasing the risk of exposure. They may be emitted from various industrial processes, such as metal melting operations, anodizing and plating operations, and different types of metal working. To address this priority, the CSC expressed interest in pursuing air monitoring to identify sources of elevated levels of toxic metal emissions and conducting follow-up actions if persistent elevated levels of toxic metal emissions are detected. Follow-up actions may include additional air monitoring and investigation efforts, inspection of nearby facilities, and/or focused enforcement.

Method

South Coast AQMD's efforts to address this air quality priority in ELABHWC started with a systematic identification and prioritization of potential sources of air toxic metals emissions. Advanced air monitoring technologies were then used to confirm the presence of specific emission sources and to further characterize these 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 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 (Attachment A).

In addition, South Coast AQMD has been conducting source-oriented ambient air monitoring using different strategies and techniques, typically involving the use of mobile measurements and/or fixed monitoring near one or more facilities. Based on information originally included

in the CERP there are 31 metal processing facilities in the ELABHWC community (Figure 1) which have a potential to emit metal toxic air contaminants. Further investigation allowed South Coast AQMD to identify additional facilities with equipment meant for metal processing. South Coast AQMD uses a variety of tools for air monitoring depending on the pollutant(s) of interest, location of the facility, area available to site a fixed monitor, and other considerations. In prior air toxic metals investigations and in order to satisfy existing rules, South Coast AQMD either utilized or required the use of stationary monitors (e.g. portable battery-operated samplers that could be deployed on utility poles) that provide time-integrated samples for subsequent metal analysis.

In addition to the time-integrated sampling, South Coast AQMD utilizes continuous multi-metals monitoring either at a fixed location (e.g. stationary monitoring at Resurrection Church) or inside a mobile platform to measure the ambient concentrations of a specific list of metal compounds. As part of an evaluation test to determine the suitability of the continuous multi-metals monitor in mobile applications, South Coast AQMD partnered with Aerodyne Research LLC and this monitor was installed in a specialized mobile platform and used to identify air toxic metals hotspots and pinpoint areas for further investigation or placement of fixed monitors (Attachment B). The combination of source-oriented time-integrated measurements and mobile surveys will help identify facilities that have the potential to contribute to air quality issues. This may lead to facility inspections and/or enforcement actions, when needed and appropriate.

Some of these metal processing facilities also conduct metal finishing operations that could lead to hexavalent chromium (Cr6+) emissions. The continuous multi-metals monitors cannot measure Cr6+, which at the moment can only be detected using time-integrated sampling and analysis. While facilities in ELABHWC (Figure 1) are not known to be emitting high levels of Cr6+, air monitoring using the appropriate technology will help confirm whether they could pose a significant health risk to this community.

These air monitoring investigations are expected to take several months and South Coast AQMD will continue to provide periodic updates to the CSC. When the South Coast AQMD initiates air monitoring investigations and identifies a specific air quality issue, follow-up actions are taken to implement interim measures to reduce the health risk to the community. However, it can take many months to several years until a facility has fully implemented permanent pollution control measures. To ensure public health is protected, the South Coast AQMD will continue ambient air monitoring until permanent pollution control measures have been fully implemented. South Coast AQMD is also in the process of developing the Proposed Rule 1480 – Ambient Monitoring and Sampling of Metal Toxic Air Contaminants (Attachment C), which will transfer the responsibility for conducting ambient air monitoring to the facility that is posing a health risk to the community.

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
- Preliminary analysis of the November 2019 mobile air monitoring data identified elevated levels of total chromium and arsenic on Sichel Street on the north side of the ELABHWC community (Attachment B). These observations led South Coast AQMD to perform longer-term stationary measurements of Cr6+ and other metals at this location (Attachment B). Stationary monitoring was carried out between November 2019 and March 2020
- Stationary measurement results on Sichel street showed that the average levels of most metals are comparable to the ambient concentrations measured elsewhere in the Los Angeles Air Basin, except for the average total chromium and Cr6+ which were slightly higher than the average background levels in the region (Attachment B)
- In response to these findings, Compliance and Enforcement staff conducted onsite investigations, collected samples at the facility, and returned multiple times to conduct follow-up inspections. This resulted in the issuance of three Notices to Comply and one Notice of Violation

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 the analysis of mobile monitoring data to identify air toxic metals hotspots, quantify the levels of air toxic metals around metals processing facilities of concern, and help identify other unknown sources of emissions
- Continue the investigations on Sichel Street to assess the levels of air toxic metals and support inspections
- As a result of the work conducted by Aerodyne the South Coast AQMD started the development of an XRF-based mobile platform to continue mobile metal monitoring in this and other AB 617 communities. This mobile platform will be ready for deployment in the first quarter of 2021
- Continue the enhanced enforcement activities to address elevated emissions when detected through air measurements

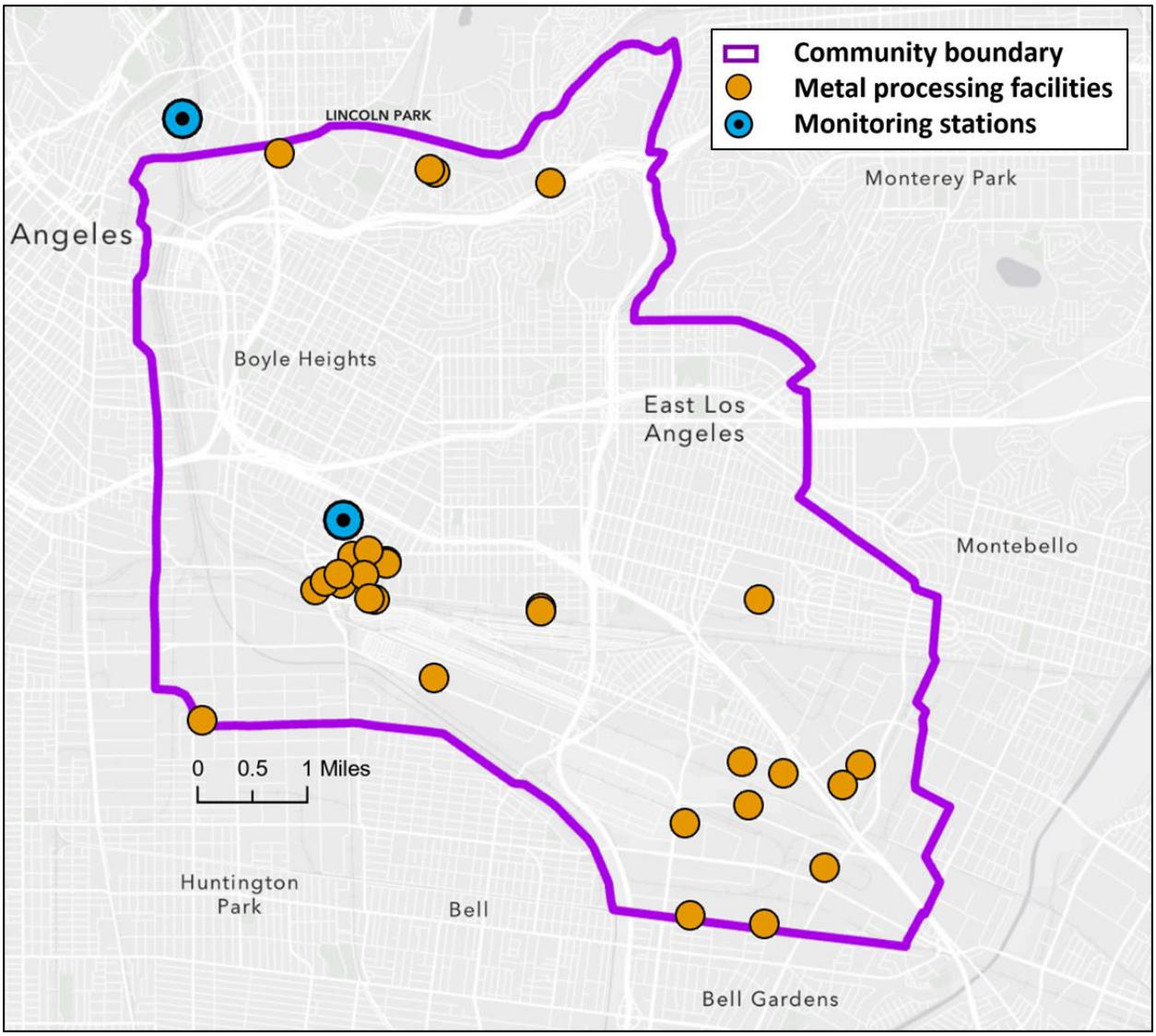

Figure 1. Location of metal processing facilities within the ELABHWC community, as well as locations of the monitoring stations for baseline measurements

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

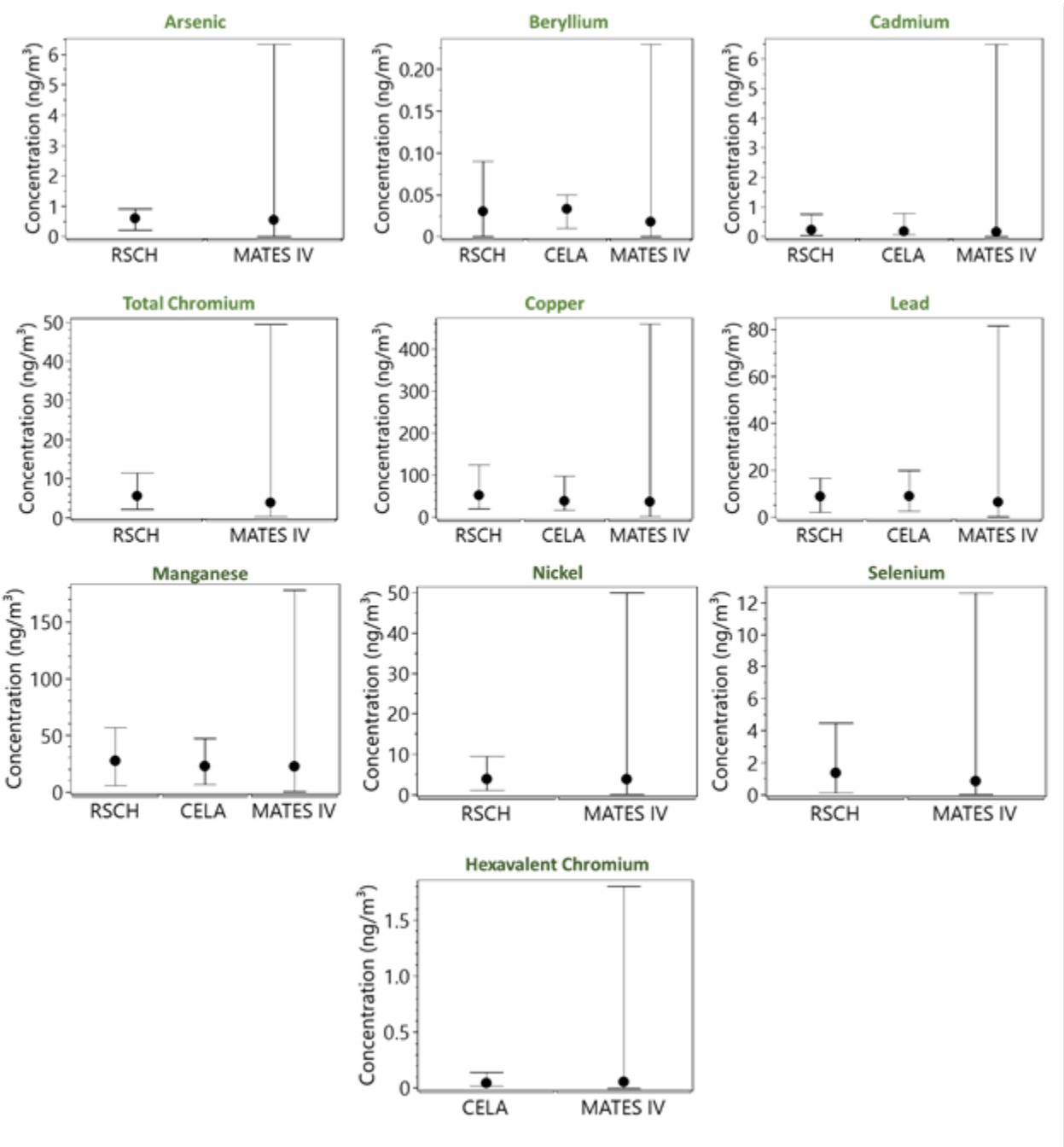

Figure A-1. Concentrations of metals in total suspended particles (TSP) measured at Central Los Angeles (CELA) site, where applicable and Resurrection Church (RSCH) site along with a comparison with levels measured during MATES IV. Black dots are average concentrations and error bars show the range (minimum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

[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.

Resurrection Church site in March 2020 and have been measuring concentrations of several 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 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 fewer attempts have 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 metal-processing facilities. The routes traversed by the Aerodyne's mobile platform and locations of metal-processing facilities within the ELABHWC community are shown in Figure B-1.

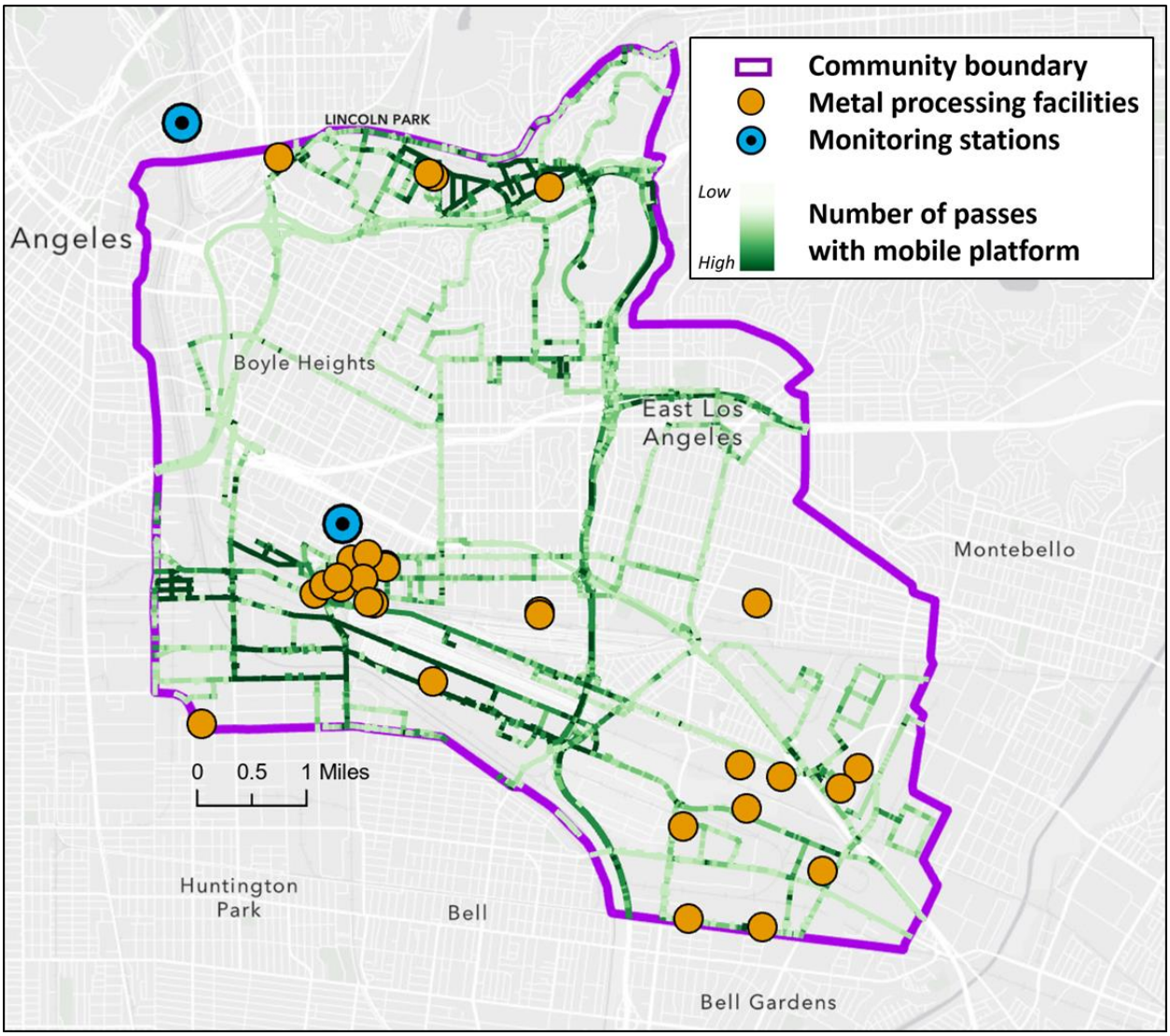

Figure B-1. Map illustrating the routes traversed by the Aerodyne's mobile platform used to monitor particulate metals with Xact 625i, as well as the location of monitoring stations for baseline measurements

The "aggregated" maps of the spatial pattern (or concentration gradient) of important metals and elements around the metal-processing facilities that are located within the ELABHWC community, as measured by the mobile monitoring platform during those nine days are presented below. 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 are presented for 4 important metals, including Cadmium (Cd), Nickel (Ni),

Chromium (Cr), and Vanadium (V). The first two metals (i.e., Cd and Ni) are selected because they are categorized by the United States Environmental Protection Agency (U.S. EPA) as Hazardous Air Pollutants (HAPs), or air toxics. Cr and V 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-2 to B-5 illustrate aggregated maps of the spatial variations of these important metals, with respect to the location of metal-processing facilities within the ELABHWC community. 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. Most metals show elevated concentrations near metal-processing facilities clusters 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 metal-processing facilities located near E Washington Blvd., as well as near the facilities located to the southeast of the community. It should be noted that these are the locations with clusters of auto body shops, i.e. another air quality priority selected by the CSC which could be another potential source of these metals, hence there might be some contribution from those facilities as well (see the progress report on Auto Body Shops in ELABHWC).

In addition to the elevated concentrations of metals near metal-processing facilities, 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 metal processing facilities and auto body shops, they are also 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 on roadways and other surfaces, which can become resuspended due to traffic-induced turbulence. The most important abrasion processes which results 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.

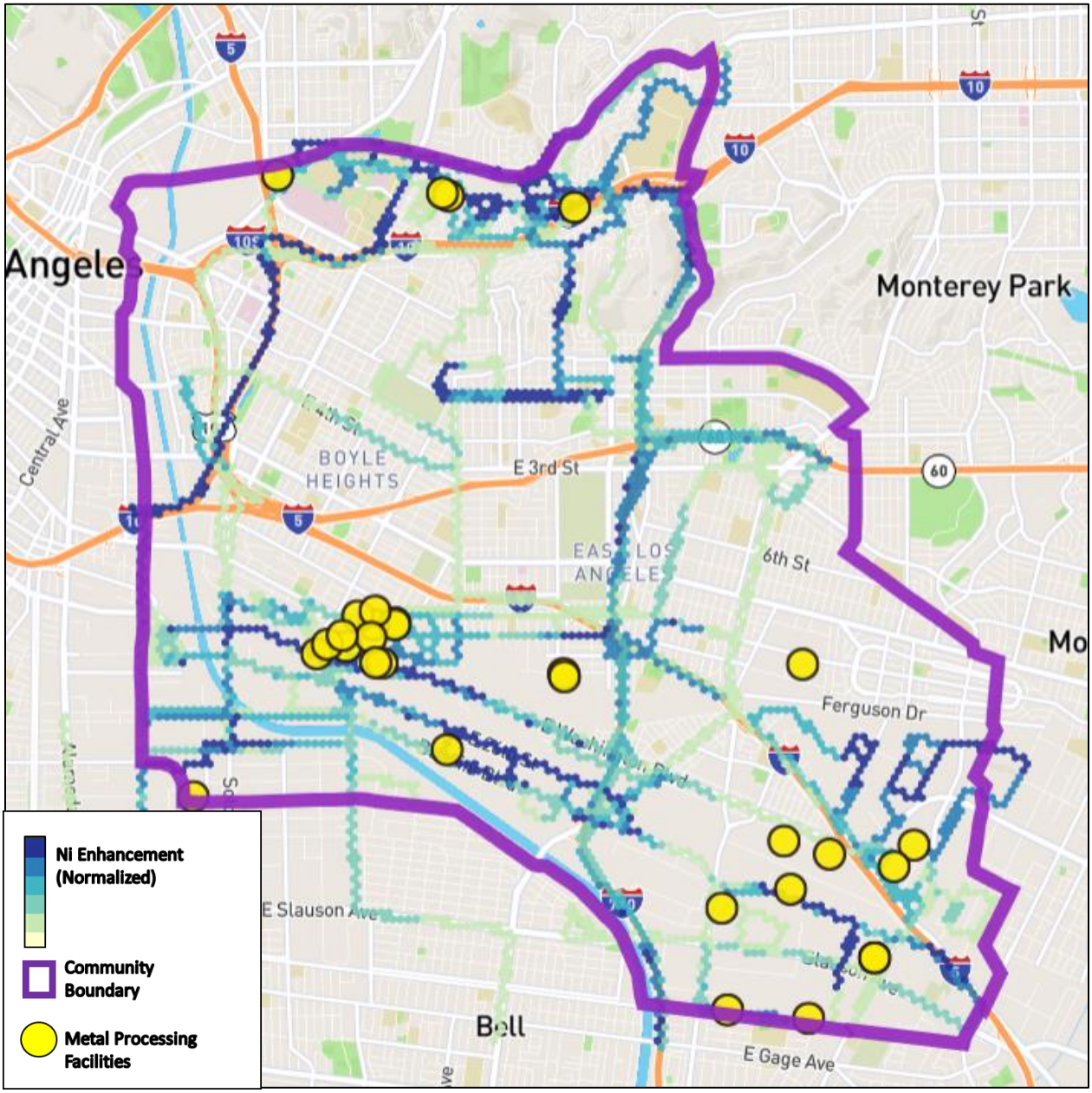

Figure B-2. Aggregated map of the spatial pattern of Ni concentrations around metal-processing facilities within the ELABHWC community, as measured by the mobile monitoring platform

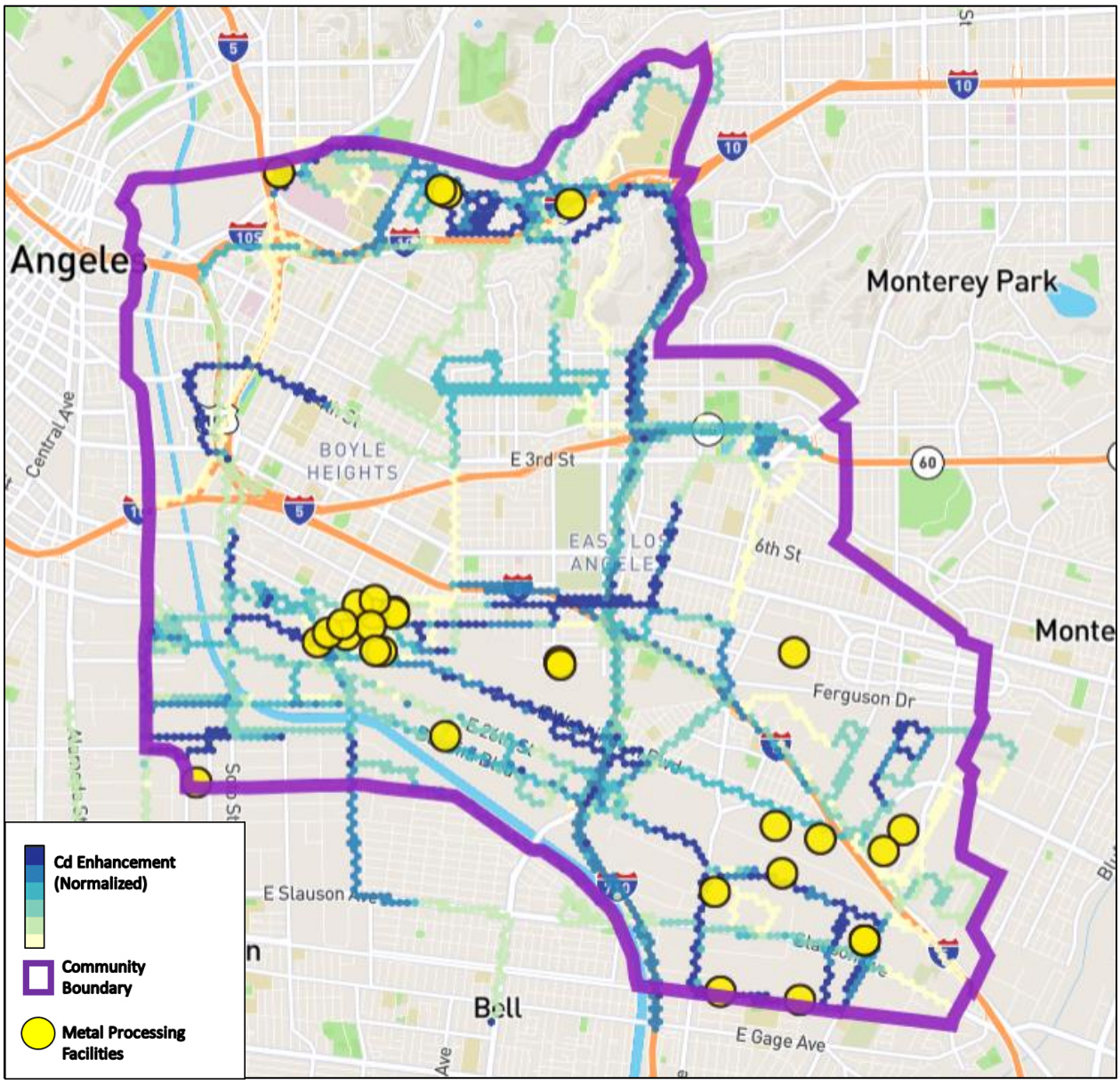

Figure B-3. Aggregated map of the spatial pattern of Cd concentrations around metal-processing facilities within the ELABHWC community, as measured by the mobile monitoring platform

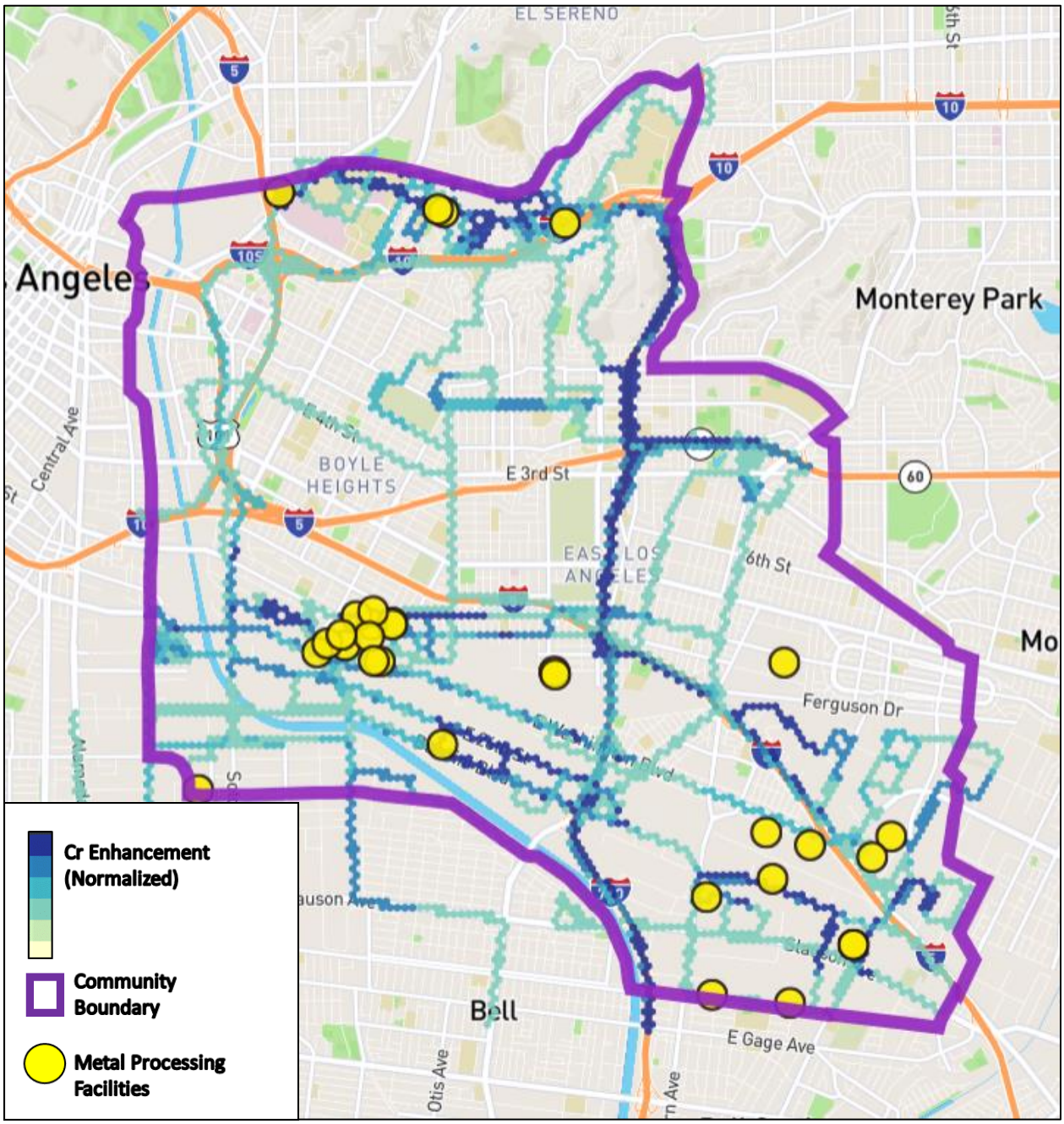

Figure B-4. Aggregated map of the spatial pattern of Cr concentrations around metal-processing facilities within the ELABHWC community, as measured by the mobile monitoring platform

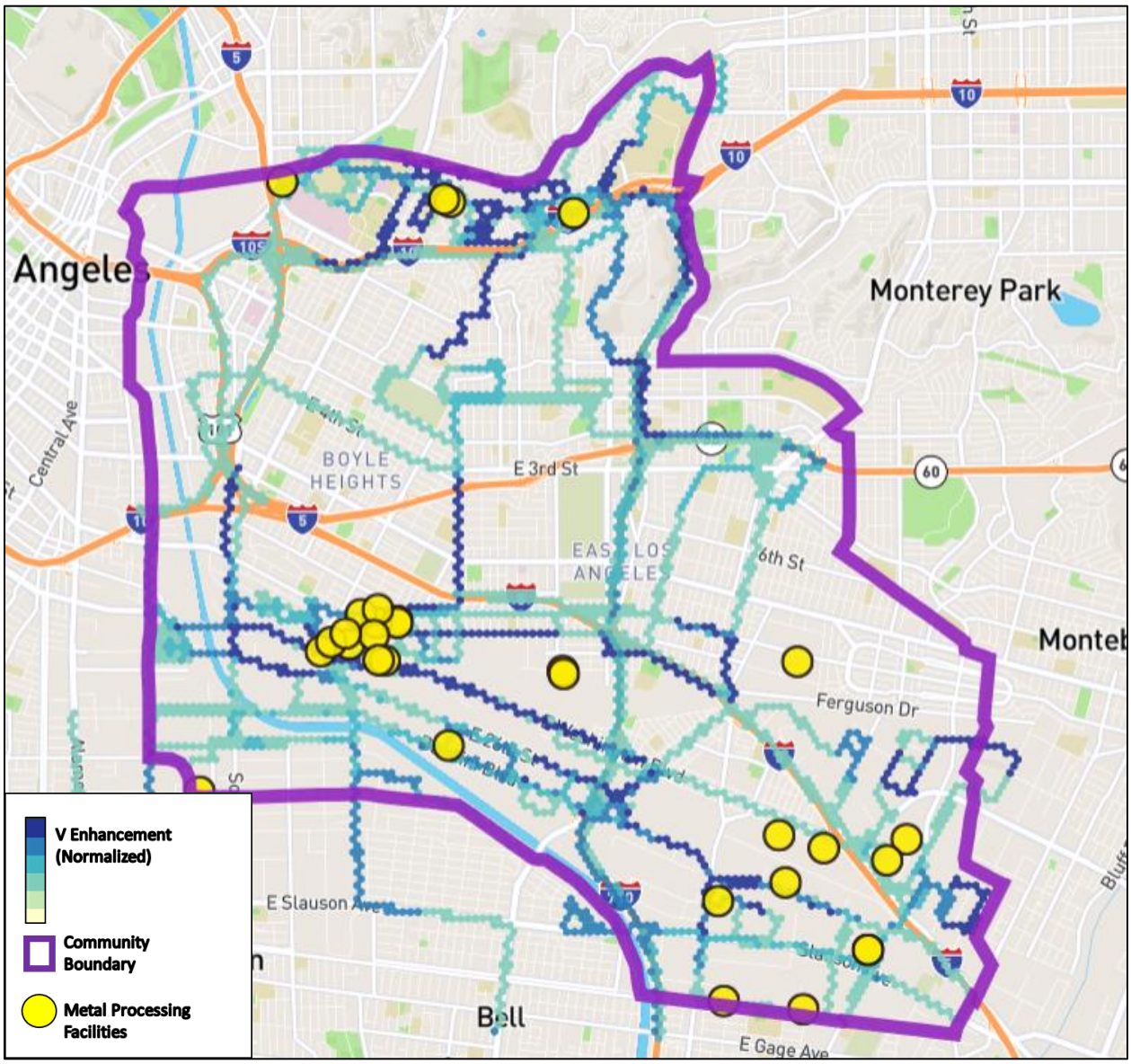

Figure B-5. Aggregated map of the spatial pattern of V concentrations around metal-processing facilities within the ELABHWC community, as measured by the mobile monitoring platform

One of the areas where persistently elevated levels of total chromium and arsenic were measured during the mobile monitoring was on Sichel Street on north side of the community (Figure B-6). These observations led South Coast AQMD to perform follow-up stationary measurements of Cr6+ and other metals at this location. Stationary monitoring with 24-hr time-integrated samplers was carried out between November 2019 and March 2020 at a parking lot on Sichel Street (Figure B-6). Similar to the baseline measurements explained in Attachment A, stationary measurement results on Sichel Street were compared against MATES IV levels. Results showed that the average levels of most of metals on Sichel Street are comparable to the average

concentrations that are measured elsewhere in the South Coast Air Basin, except for average total chromium and Cr6+ which were slightly higher than the average background levels, but still within the typical ranges, in the region (Figure B-7).

Figure B-6. Enhanced concentrations of total chromium and arsenic measured by the mobile platform and the location of stationary metals monitor on Sichel Street

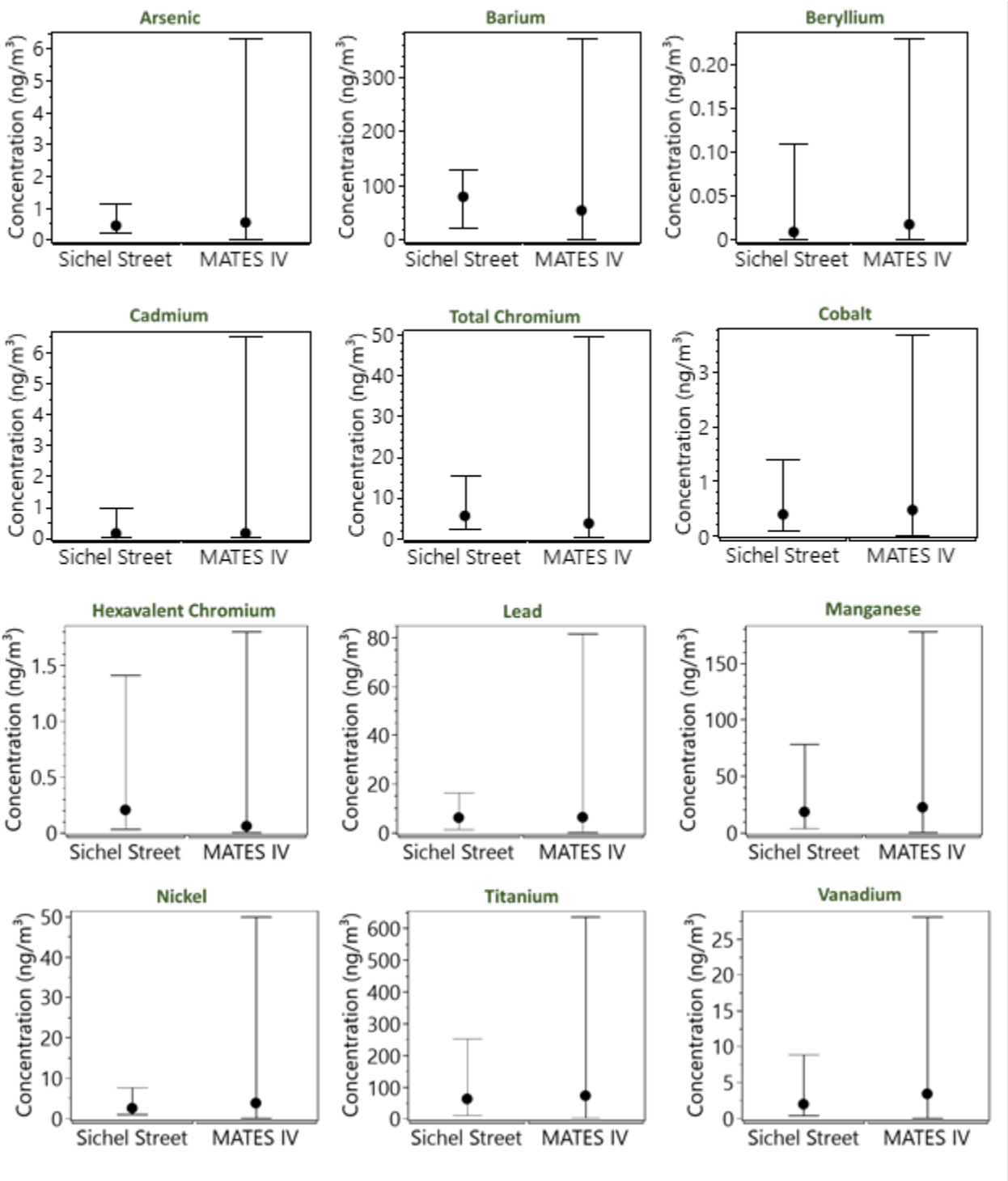

Figure B-7. Concentrations of metals measured by the stationary monitor on Sichel Street and comparison with levels measured during MATES IV. Black dots are average concentrations and error bars show the range (minimum and maximum) of variation

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

In December 2019, the South Coast AQMD adopted a rule that applies to metal processing facilities, Rule (R) 1480 – Ambient Monitoring and Sampling of Metal Toxic Air Contaminants. Under Rule 1480, the responsibility of ambient air monitoring would be transferred to the facility that is posing the health risk. Rule 1480 is needed to ensure that ambient levels of air toxic metals near facilities with significant risk levels are being monitored. Operations with air toxic metals emissions can have significant fugitive emissions and monitoring near facilities has shown high levels of air toxic metals. When a Potentially High-Risk Level Facility is identified through Rule 1402, it can take two to three years to install permanent pollution controls and measures required by the Risk Reduction Plan. During this interim period, ambient air monitoring can monitor emissions from the facility to ensure air toxic metals emissions are not increasing. In addition, the ambient air monitoring data is a tool that can be used to verify reductions of air toxic metals emissions and track the progress during the implementation of the Risk Reduction Plan. Additionally, the elevated levels alert the South Coast AQMD of certain activities that may generate emissions. Rule 1480 does not require measures to reduce emissions, but instead would provide information regarding emissions. The primary means in which air toxic metals emissions would be reduced is through the requirements of Rule 1402[6] under the provisions for a Potentially High-Risk Level Facility. The facility would be designated pursuant to Rule 1402 and Rule 1480 based on designation criteria, which includes health risks exceeding the Significant Risk Level for metal TACs. Rule 1480 would require the facility to conduct ambient air monitoring and sampling for specific metal TACs until the Risk Reduction Plan under Rule 1402 is implemented or it is determined that a Risk Reduction Plan is not needed, whichever is sooner.

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