Action: Conduct focused air monitoring near concrete batch, asphalt batch, and rock and aggregate plants to identify any potential elevated levels of emissions

Background and Objectives

The community steering committee (CSC) of San Bernardino, Muscoy (SBM) identified fugitive dust, particulate matter (PM), and odors from concrete batch, asphalt batch, and rock aggregate batch plants as an air quality concern in this area, and emphasized addressing fugitive dust and PM emissions within close proximity to schools. There are two plants within the boundaries of the SBM community (Figure 1): Robertson's Ready Mix, a concrete batch plant that borders Arroyo Valley High School and is one half of a mile from Ramona-Alessandro Elementary School; and Vulcan Materials, an aggregate batch plant.

One of the actions identified by the CSC is to conduct focused air monitoring near Robertson's Ready Mix and Vulcan Materials to check for any potentially elevated levels of emissions. If persistent elevated levels are detected through air monitoring, appropriate follow-up investigations should be conducted (e.g., on-site testing and/or other types of investigations and data review). Facilities that handle cement have the potential to emit hexavalent chromium (Cr6+), a potent air toxic pollutant and human carcinogen, which was investigated.

Method

A combination of mobile and fixed air monitoring was employed to address this air quality priority (see Attachment A for details). Monitoring began with mobile measurements near Robertson's Ready Mix and Vulcan Materials to guide site selection for fixed air monitoring (Attachment B). Low-cost sensors (Clarity Movement Co.) were deployed at the selected upwind and downwind sites near both facilities for measuring PM_{10} (inhalable particles less than 10 microns in diameter) and $PM_{2.5}$ (fine particulate matter or particles less than 2.5 microns in diameter) to assess the contribution of fugitive dust emissions from the facilities to the overall air pollution burden in this community (Attachment C). Additional mobile monitoring surveys were conducted during Santa Ana wind events, which can cause windblown dust, to assess the effect of high winds on local dust. Elevated levels of PM_{10} can occur during these dust events throughout the SBM community. Two mobile monitoring surveys were conducted during Santa Ana wind events on October 11 and 30, 2019, to determine if emissions from Robertson's Ready Mix and Vulcan Materials contribute additional burden to the overall high PM_{10} levels in this community (Attachment D).

In addition, a set of 10 filter samples were collected near Robertson's Ready Mix and Vulcan Materials in August and September of 2019 and analyzed for Cr6+ to determine if these facilities are potential sources of Cr6+ emissions.

Results

- As of June 2020, eight mobile surveys were conducted in the community to measure PM levels and address the dust issue in SBM (Attachment A)
- Preliminary mobile monitoring on August 6, 2019 showed elevated levels of PM_{10} around Robertson's Ready Mix and Vulcan Materials (Attachment B). Based on these results low-cost sensors were deployed around the two cement facilities to assess their fugitive dust emission contributions to the overall air pollution burden in SBM (Attachment C)
- PM_{10} levels measured by the low-cost sensors from September 2019 to July 2020 near Robertson's Ready Mix and Vulcan Materials did not show any significant emission contribution from these two facilities in that period (Attachment C)
- It was determined that the low-cost sensors have poor performance for PM_{10} measurements during high wind conditions (Attachment C). Thus, stationary monitoring with the mobile platform were also conducted around the facilities to assess their contributions to local PM_{10} levels (Attachment D)
- Mobile surveys and stationary measurements conducted with the mobile platform showed that Santa Ana events can cause elevated PM_{10} concentration at locations immediately downwind of the cement facilities, and their impact decreased at locations further downwind (Attachment D)
- Cr6+ concentrations were at background levels for all samples collected from upwind and downwind sites near both facilities, which concludes the Cr6+ measurements (Attachment E)

Next steps

- Additional PM_{10} monitoring may be conducted to further evaluate potential contributions of fugitive dust emissions from these two facilities during Santa Ana and other high wind events

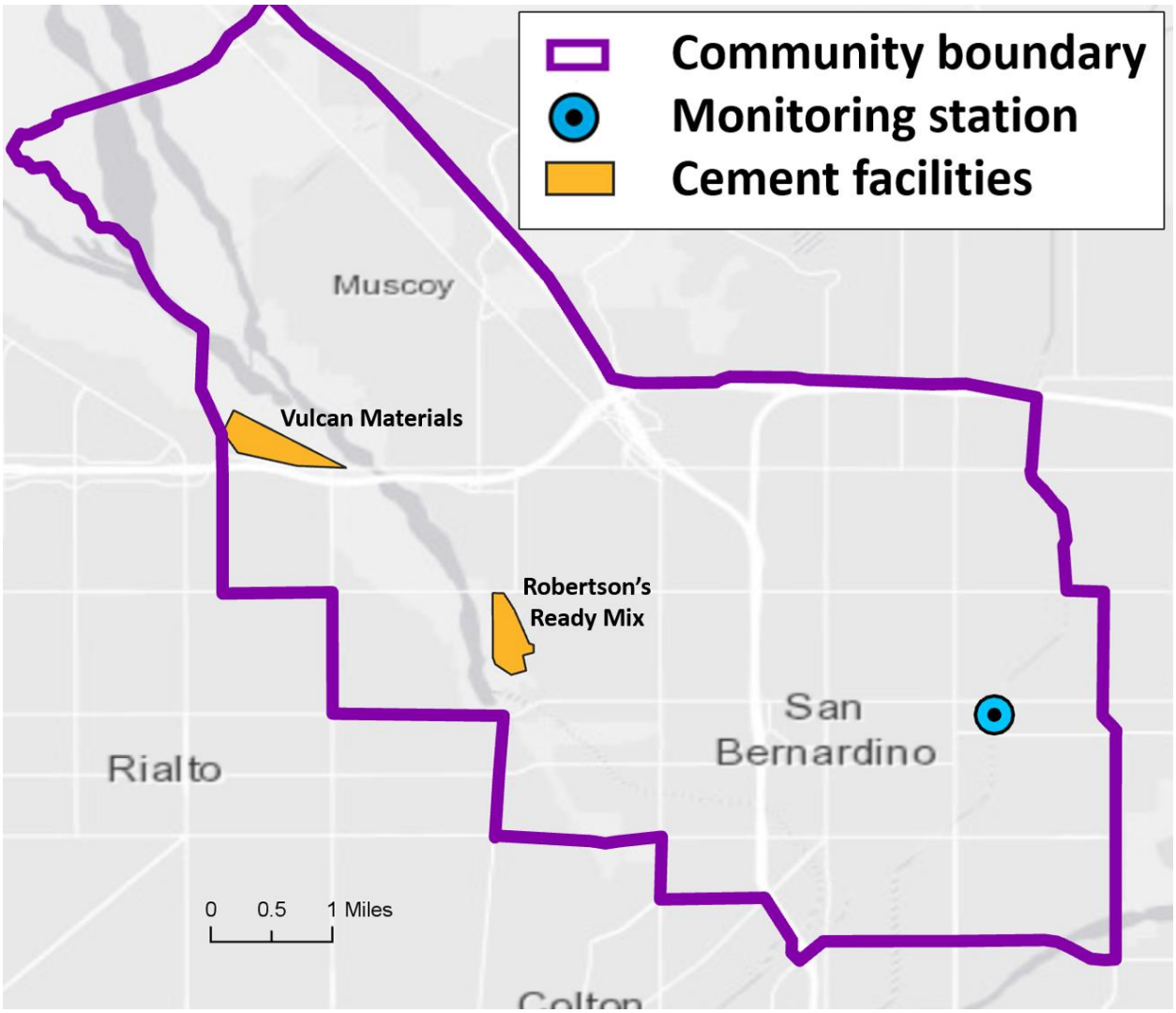

Figure 1- Map showing the locations of the two cement handling facilities within the SBM community boundary, as well that of the South Coast AQMD monitoring station used for baseline measurements operated by the South Coast AQMD

Attachment A

As of June 2020, a total of eight mobile monitoring surveys have been conducted in the San Bernardino, Muscoy (SBM) community (between 8/6/19 and 12/18/19) to measure PM concentrations as part of the area-wide and targeted surveys. This includes targeted mobile measurements of PM_{10} (inhalable particles less than 10 microns in diameter) concentrations in upwind and downwind areas near Robertson's Ready Mix and Vulcan Materials facilities (Figure A-1). In addition to the mobile measurements, continuous fixed monitoring of PM_{10} using a federal equivalent method (FEM) has been ongoing at the San Bernardino Air Monitoring Station (which is part of South Coast AQMD's air monitoring network).

After completing these measurements, it was determined that the instrument used for PM mobile monitoring had a response time of 40 to 60 seconds and the GPS measurements are not completely synchronized with the concentration values. Due to further updates and changes in the setup, it was not possible to correct the data to account for this problem and these measurements were flagged as not accurate. Thus, the PM maps shown in this report are not 100% accurate. As a result, the instrument was replaced with one with a lower response time.

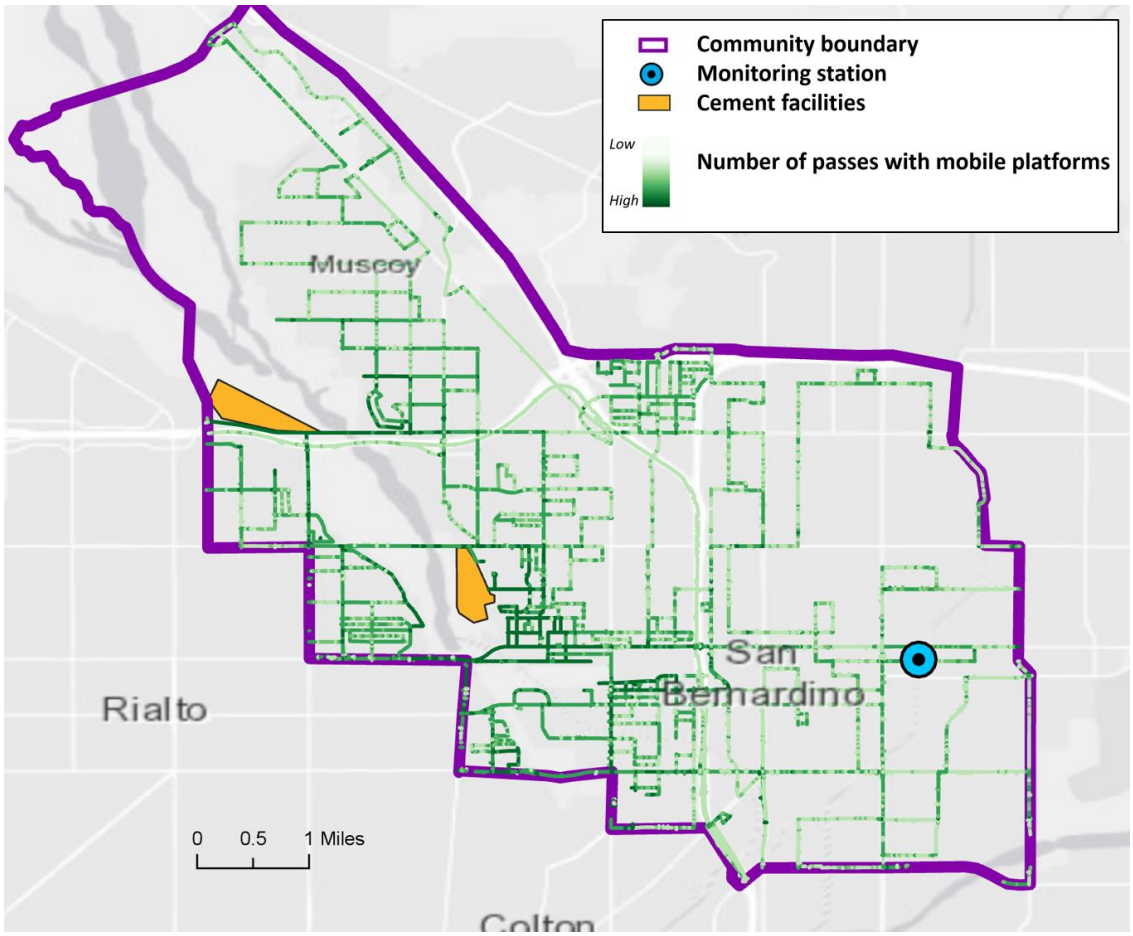

Figure A-1- Map showing the location of cement handling facilities in SBM and the routes traversed by the mobile platform. The location of the of the South Coast AQMD monitoring station for baseline measurements is also included

Attachment B

On August 6, 2019 a measurement survey was conducted to measure PM_{10} (inhalable particles less than 10 microns in diameter) concentrations upwind and downwind of the Robertson's Ready Mix and Vulcan Materials facilities in SBM community. The results indicate an increase in PM_{10} concentration levels in the streets next to these facilities, especially on the south side of Vulcan Materials and East side of Robertson's Ready Mix. These results were presented to the SBM community steering committee (CSC) during the October 2019 AB 617 meeting and were used to select appropriate locations for fixed monitoring samplers and sensors (Figure B-1).

Figure B-1- Map showing PM_{10} measurements from the mobile monitoring survey conducted on August 6, 2019

Attachment C

Upwind and downwind locations were chosen for each facility based on the results of the mobile monitoring survey as explained in Attachment B and considering the typical wind patterns in the area (Figure C-1). Low-cost sensors (Clarity Movement Co.) were deployed at the selected upwind and downwind sites near both facilities to measurement PM_{10} (inhalable particles less than 10 microns in diameter) and $PM_{2.5}$ (fine particulate matter, or particles with a diameter less than 2.5 microns) to assess the contribution of fugitive dust emissions from the facilities to the overall air pollution burden in this community. These sensors have been tested by South Coast AQMD's Air Quality Sensor Performance Evaluation Center (AQ-SPEC) and showed generally good agreement for $PM_{2.5}$ concentration measurements with the FEM instruments.

Figure C-1- Maps showing the locations of the upwind and downwind sensors that were deployed near Robertson's Ready Mix and Vulcan Materials

The results from measurements conducted between September 2019 to July 2020 show that the ambient levels of PM_{10} were lower than the California Ambient Air Quality Standard for this pollutant (50 ug/m^3; 24-hour standard) (Figure C-2), and significantly lower than National Ambient Air Quality Standard for PM_{10} (150 ug/m^3; 24-hour standard). Data from sensors did not show a significant difference between upwind and downwind locations and a clear contribution from the cement facilities was not detected. Preliminary results from these sensors were presented to the CSC in the October CSC Meeting as part of the "Updates on Community Air Monitoring in SBM" presentation.

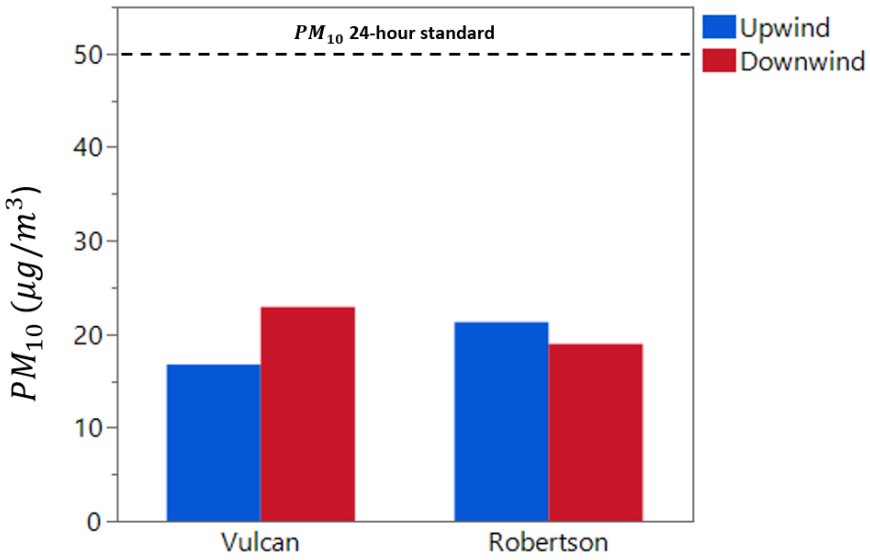

Figure C-2- Average concentration levels measured from September 2019 to July 2020 using low-cost sensors downwind and upwind of Robertson's Ready Mix and Vulcan Materials. The dashed line shows the California 24-hour standard

To confirm if the results from the sensors are valid, concentration levels measured with the low-cost sensors at the South Coast AQMD San Bernardino Air Monitoring Station are compared with the federal equivalent method (FEM) PM_{10} monitor at the same location. The results from measurements taken between October 1 and October 15, 2019 suggest that low-cost sensors have a poor performance for PM_{10} (Figure C-3). Specifically, these sensors were not able to detect high PM_{10} levels were measured by the FEM instrument on October 10 and 11, 2019. Because of the inaccurate data from these low-cost devices during high wind events, stationary measurements using the monitors in the mobile platform were conducted around Robertson's Ready Mix and Vulcan Materials to assess the contribution of these facilities to the ambient PM_{10} levels (Attachment D).

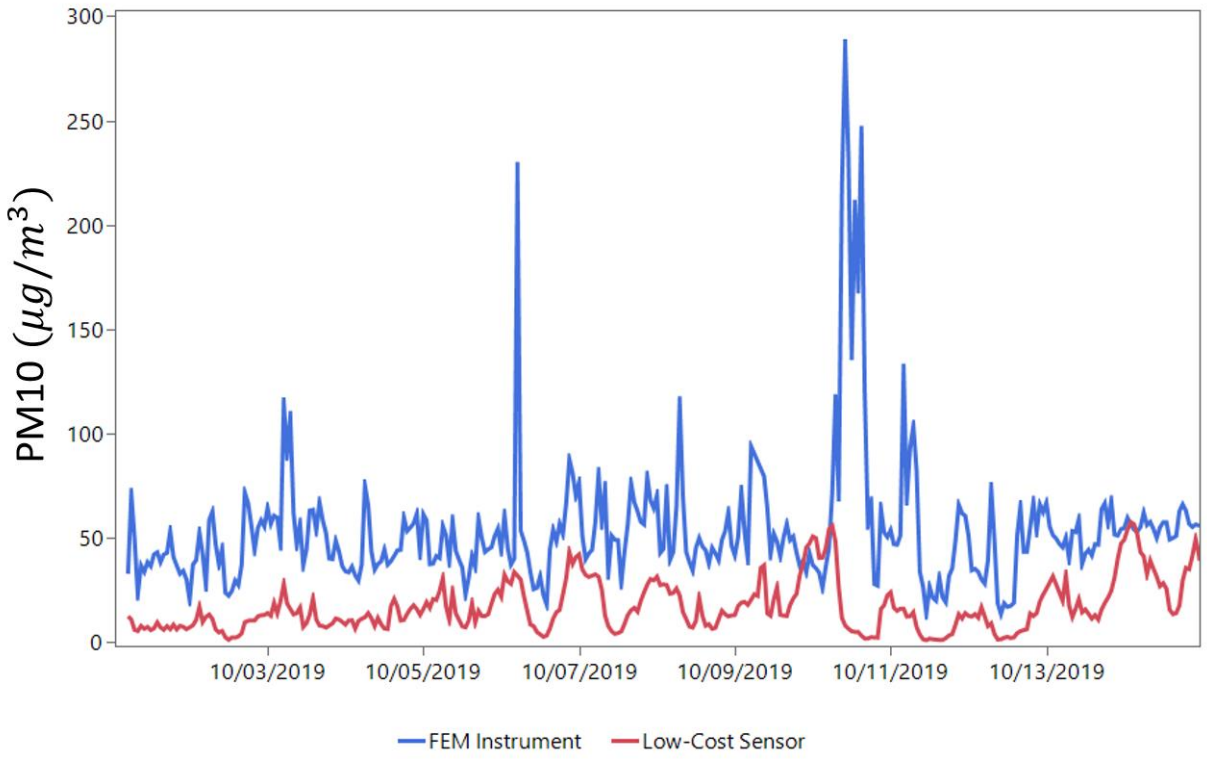

Figure C-3- Low-Cost sensor performance compared to a FEM instrument at the San Bernardino Station operated by the South Coast AQMD

Attachment D

Santa Ana wind events are among the major causes of high PM_{10} concentration in the SBM community. These are strong, extremely dry downslope offshore winds that originate inland and affect Southern California. These winds typically account for the highest wind events in the South Coast Air Basin, occurring several times each year with major contributions to high PM_{10} concentration events. Some examples of the past dust events due to Santa Ana winds can be found here.

During the Santa Ana wind events of 10/11/2019 and 10/30/2019, mobile monitoring was conducted to assess the effect of high winds on the dust levels around Robertson's Ready Mix and Vulcan Materials and determine if these facilities contribute to the high PM_{10} levels in the area. On 10/11/2020 the monitoring consisted of only mobile surveys while on 10/30/2019 the mobile platform conducted both mobile and stationary measurements at potential high dust areas at upwind and downwind locations of the facilities. The San Bernardino monitoring station was able to measure the regional effects of Santa Ana winds on PM_{10} levels on October 11\, as shown in Figure D-1. The PM_{10} instrument at the San Bernardino station was not working during the October 30 event.

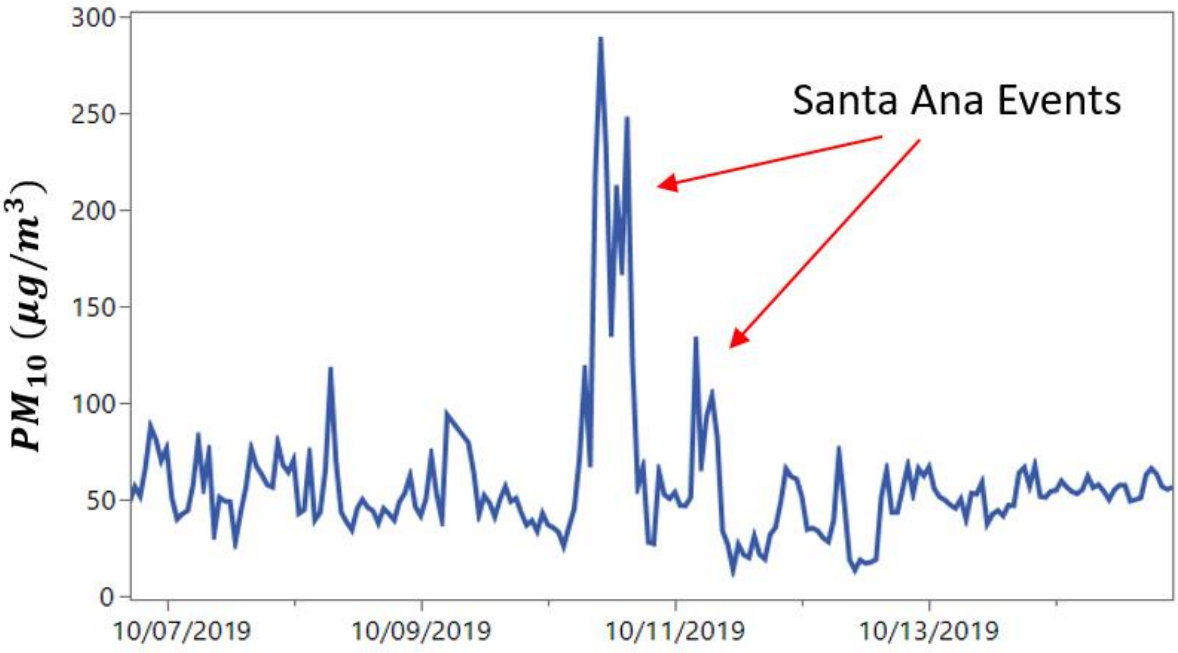

Figure D-1- PM_{10} levels measured at the regional San Bernardino station during the Santa Ana events on October 10 and October 11, 2019

The results from mobile measurements on these two days are shown in Figure D-2. Higher concentrations were observed on the immediate south side of the Vulcan Materials facility and decreased further away (and downwind) from the source. Higher PM_{10} levels were also observed on the east side of Robertson's Ready Mix.

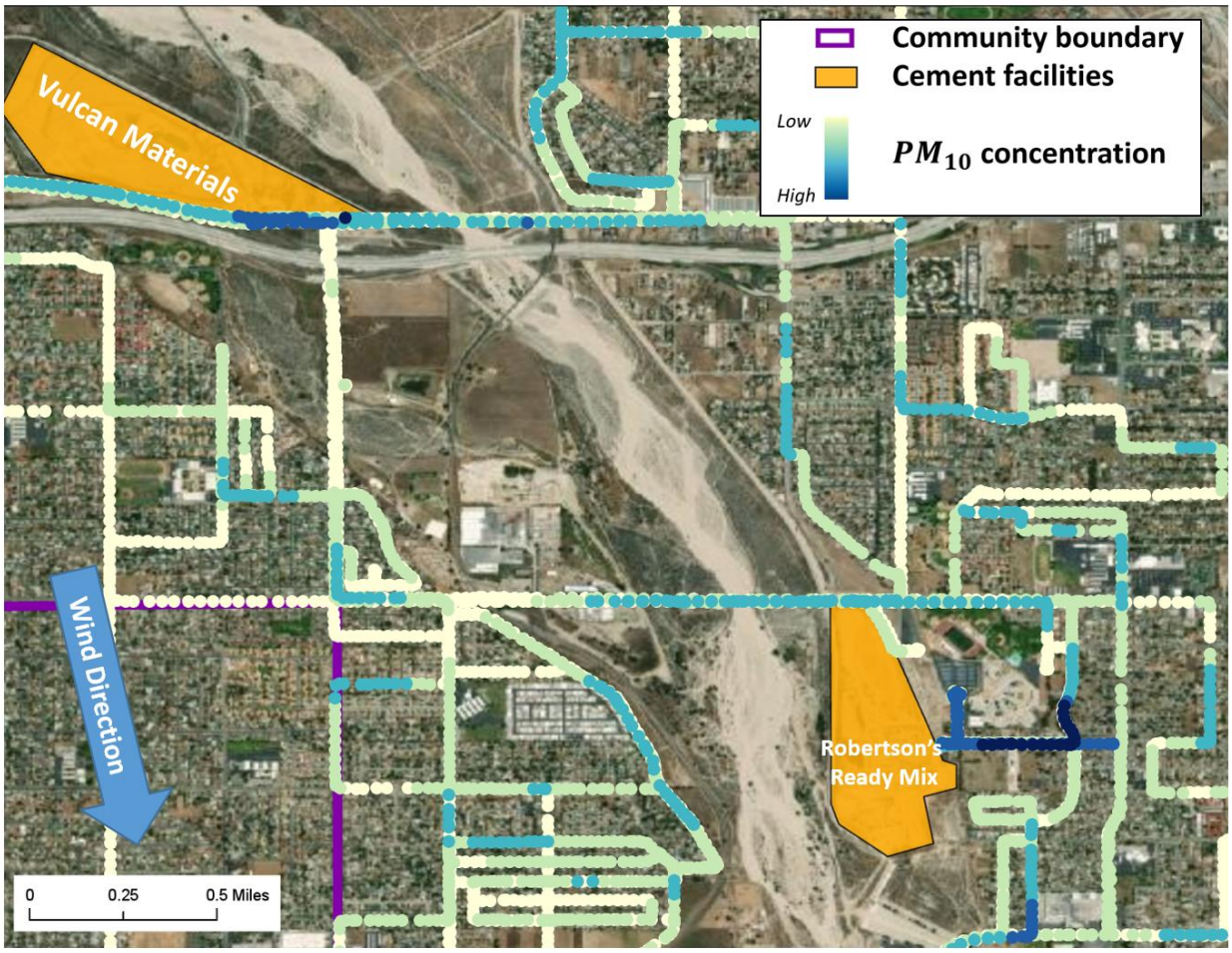

Figure D-2- Map showing PM_{10} mobile measurements around Robertson's Ready Mix and Vulcan Materials on 10/11/2019 and 10/30/2019. The blue arrow shows the average wind direction during the surveys

To further investigate the sources of dust measured during these high wind events, stationary measurements were conducted with the mobile platform. Each stationary measurement consists of 4 to 25 minutes of stationary monitoring at different stops around each of the facilities. Figure D-3 shows the average concentration at each stop. The results indicate that during Santa Ana winds, Vulcan Materials contributed to the high PM_{10} concentration at the immediate downwind

locations. While the area immediately downwind of Robertson's Ready Mix was not accessible, high concentrations were observed on the east side of the facility. Based on the wind direction, the high PM_{10} levels at this location seem to be originating from an adjacent empty land on the east side of Robertson's Ready Mix.

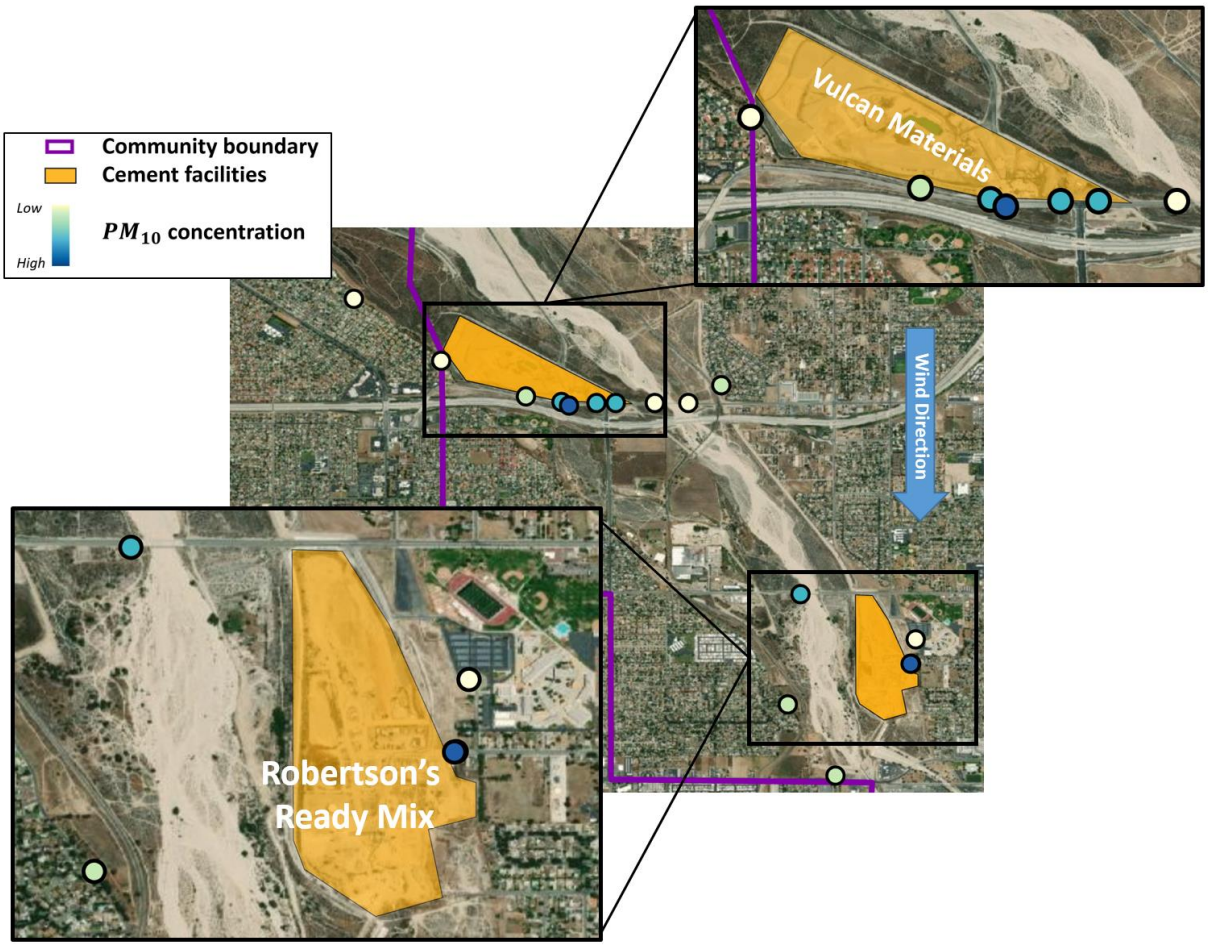

Figure D-3- Maps showing the locations where stationary measurements were conducted by the mobile platform around Robertson's Ready Mix and Vulcan Materials. The average concentration levels are also shown with colors for the measurements on October 30, 2019

Attachment E

The facilities that handle cement also have the potential to emit hexavalent chromium (Cr6+), a potent air toxic, which was investigated by collecting and analyzing Cr6+ samples near Robertson's Ready Mix and Vulcan Materials. Measurements of Cr6+ were taken to determine if these facilities are potential sources of Cr6+ emissions. A set of 10 samples were collected and analyzed for Cr6+ from each site (upwind and downwind sites at each facility) in August and September of 2019. Sampling for Cr6+ was conducted over a 24-hour period every third day (1-in-3 day sampling schedule).

Concentrations were compared to "background" or typical Cr6+ levels found elsewhere in the South Coast Air Basin. Specifically, the Cr6+ levels measured during this study were compared to those from South Coast AQMD's Multiple Air Toxics Exposure Study IV (MATES IV), a study conducted in 2012-2013 that provides a regional estimate of a representative range of typical ("background") levels of air toxic pollution from ten different locations across the South Coast Air Basin. The average concentration of Cr6+ during MATES IV is 0.045 ng/m^3. The purpose of these comparisons is to assess whether the levels measured near Robertson's Ready Mix and Vulcan Materials are consistent with those across the region. As illustrated in Table E-1 and Figure E-1, the measured Cr6+ concentrations at the two cement facilities in SBM were near "background" levels for all collected samples. Also, Cr6+ levels at downwind locations of these facilities were slightly lower those upwind. These results suggest that these two facilities do not pose a risk to the surrounding community, and no further Cr6+ investigation at these locations is needed at this time. The results were presented to the CSC in the October CSC Meeting as part of the "Updates on Community Air Monitoring in SBM" presentation.

Table E-1- Cr6+ measurements at upwind and downwind locations of Robertson's Ready Mix and Vulcan Materials in the San Bernardino community

Vulcan Materials San Bernardino

SAMPLE DATE	Upwind	Downwind
	Cr6+ ng/m³	
8/31/2019	0.03	0.03
9/3/2019	0.04	0.04
9/6/2019	0.04	0.04
9/9/2019	0.04	0.06
9/12/2019	0.06	0.03
9/15/2019	0.03	0.03
9/18/2019	0.04	0.04
9/21/2019	0.02	0.03
9/24/2019	0.05	0.04
9/27/2019	0.05	0.05

Robertson's San Bernardino

SAMPLE DATE	Upwind	Downwind
	Cr6+ ng/m³	
8/31/2019	0.03	0.03
9/3/2019	0.05	0.06
9/6/2019	0.05	0.07
9/9/2019	0.08	0.08
9/12/2019	0.04	0.04
9/15/2019	0.03	0.04
9/18/2019	0.05	0.02
9/21/2019	Invalid	0.02
9/24/2019	0.11	0.07
9/27/2019	0.04	0.05

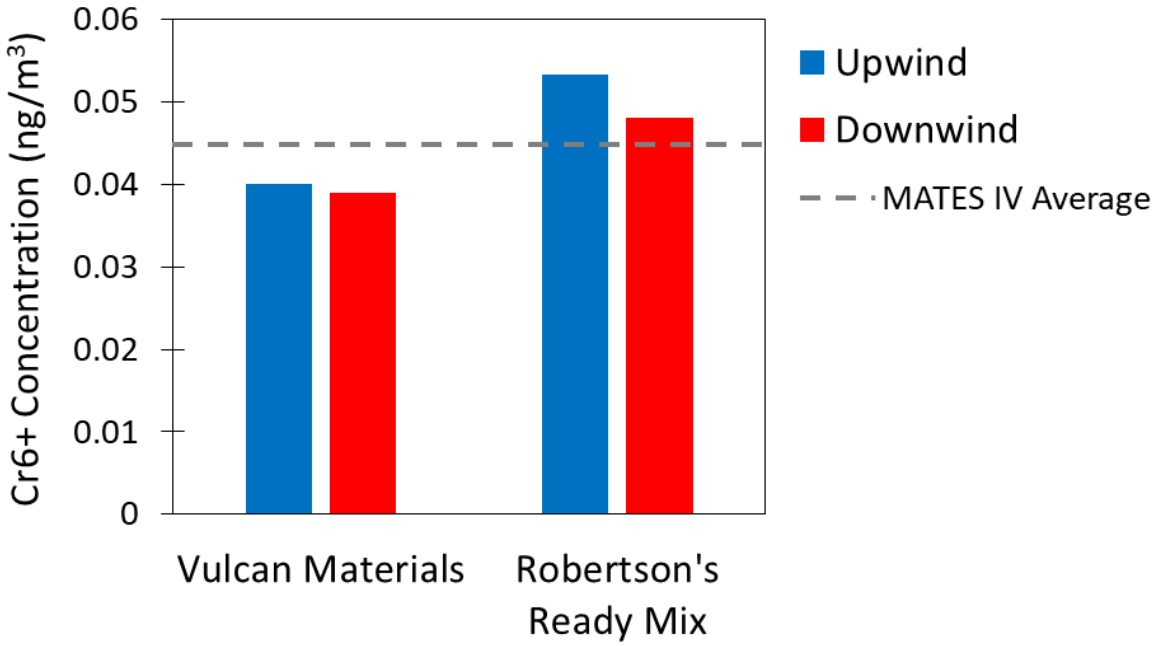

Figure E-1. Cr6+ levels upwind and downwind of Robertson's Ready Mix and Vulcan Materials