Appendix F – Site Analysis for the Phillips 66 Refinery Community Air Monitoring Station

Executive Summary

This Appendix describes the factors and analyses used to identify a geographic area for siting a community air quality monitoring station near the Phillips 66 Refinery as part of the Major Stationary Source Community Air Monitoring Program (Schedule X).[1] The goal in siting monitors under Schedule X is to select a location that will reflect typical conditions in impacted areas of the community based on a broad range of factors and the weight of available evidence associated with those factors. Importantly, no single fixed monitoring location will capture all the emissions from a given facility.

Air District staff considered several factors for this evaluation, including emissions sources, available meteorological and air quality data, area geography and topographical features, results from health risk assessments and air quality modeling, environmental justice indicators, and stakeholder input. After considering these factors, two recommended search areas emerged (Figure F-1), including:

1. In Rodeo, southwest of the refinery. Rodeo is the community nearest to the refinery and the census tract it overlaps with has a high score as an overburdened community (CalEnviroScreen composite score over the 80th percentile). While prevailing winds are from the southwest and may transport refinery-related emissions away from central Rodeo, periods of easterly or northeasterly winds also occur, which may transport emissions into the northern part of Rodeo. In addition, periods of light and variable winds may allow emissions to build up locally in communities nearest the refinery, such as Rodeo. Thus, the recommended search area encompasses the parts of Rodeo that are nearest to the refinery fenceline, which includes the Bayo Vista community immediately adjacent to the fenceline. Should a new air monitoring station be established in Rodeo, the existing Air District monitoring station in Rodeo (which measures only H_2S) should be considered for closure as measured concentrations there have been low overall, and the existing station would be redundant with a new station nearby.

2. In Crockett, east of I-80. While Crockett is not as near to the refinery compared to Rodeo, prevailing winds from the southwest may transport refinery-related emissions toward Crockett. The recommended search area in Crockett includes generally the more densely populated sections of Crockett, which are largely east of I-80 and east of the existing Air District monitoring station in Crockett. Should a new air monitoring station be established in Crockett, the existing Air District monitoring station in Crockett should be considered for closure as measured concentrations there have been low overall, and the existing station would be redundant with a new station nearby.

While either option may be suitable, it is recommended to proceed first with the search area in Rodeo for establishing a new community air monitoring station, given its closer proximity to the refinery and higher score as an overburdened community. When resources allow, subsequent monitoring at a new location within the recommended search area in Crockett should also be considered.

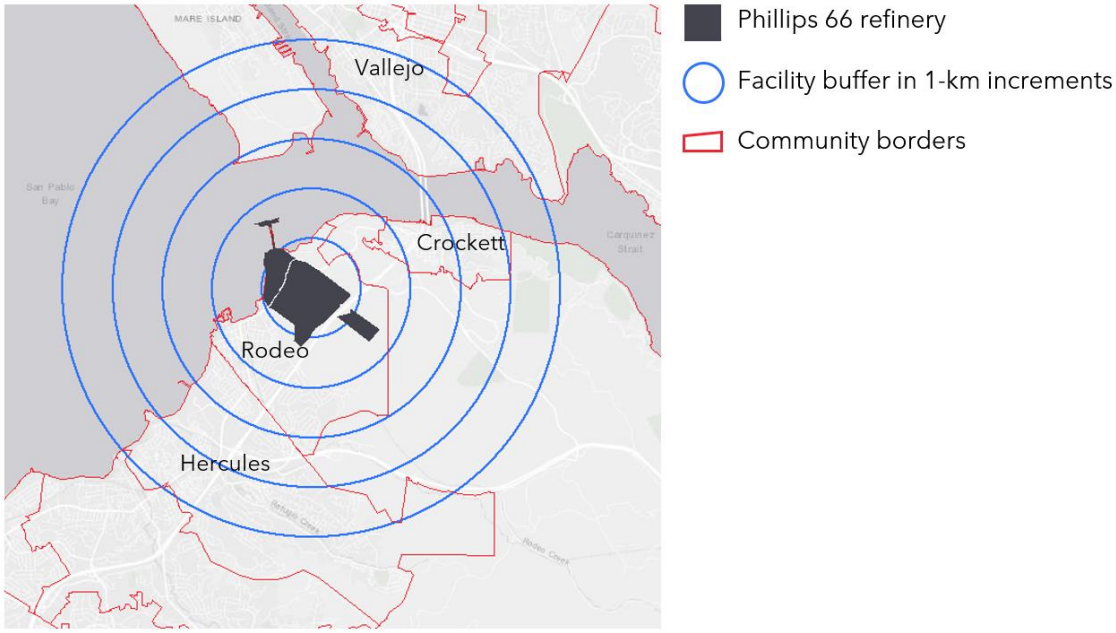
[1] Overview of the Major Stationary Source Community Air Monitoring Program: https://www.baaqmd.gov/~/media/files/technical-services/community-air-monitoring/01_refinery-camp-v7-mainapp-a-pdf.pdf

Figure F-1 – Recommended Search Area for the Phillips 66 Refinery Major Stationary Source Community Air Monitoring Station

Study Area

A neighborhood-scale monitoring station located within a few kilometers of the refinery is most appropriate given the objectives of the Major Stationary Source Community Monitoring Program. In Figure F-2, source areas at the Phillips 66 refinery are shown in gray with concentric buffers around the facility in 1 km increments. Portions of the buffers intersect the communities of Vallejo, Crockett, Rodeo, and Hercules, as well as uninhabited areas of Contra Costa County, the Carquinez Strait, and San Pablo Bay.

Figure F-2 – Location of the Phillips 66 Refinery



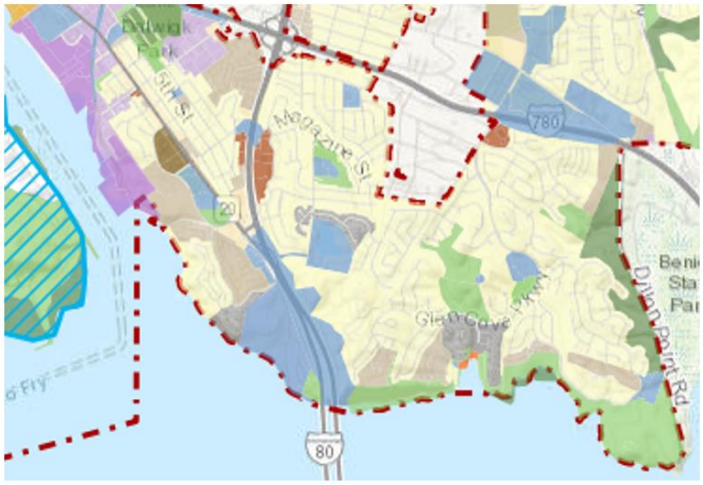
Population Centers

With an estimated population of 10,409, (US Census Bureau, 2020), the community of Rodeo is located in an unincorporated area of northwestern Contra Costa County on the eastern shore of San Pablo Bay. The Phillips 66 refinery lies within the northern portion of Rodeo, while the western and southern areas are largely residential and commercial. The eastern portion of the community extends into the Crockett Hills and is largely unpopulated.

Like Rodeo, the community of Crockett is also in an unincorporated area of Contra Costa County. With an estimated population of 3,265 (US Census Bureau, 2020), Crocket sits along the Carquinez Strait near where it empties into San Pablo Bay.

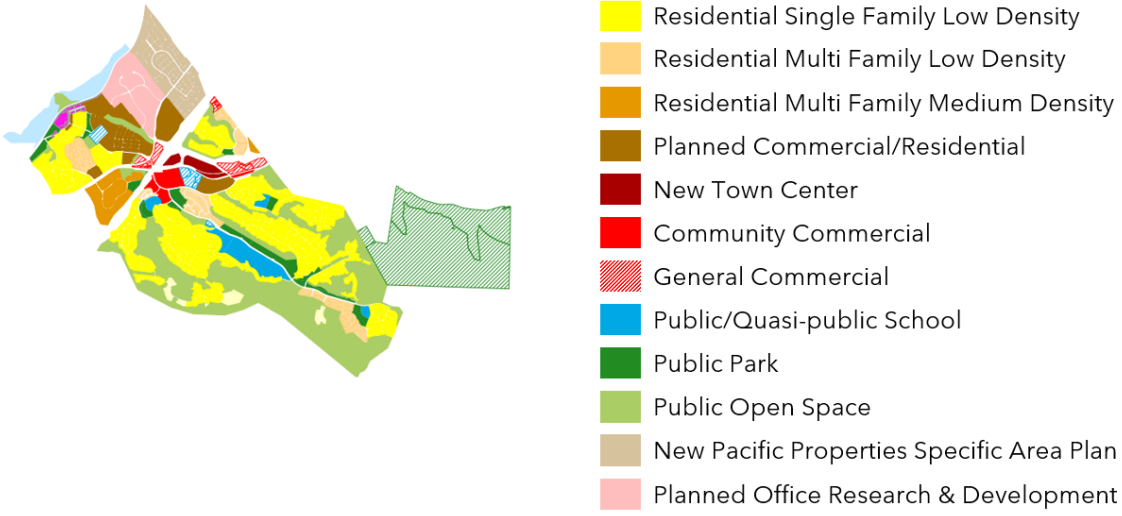
Directly across from Crockett on the northern side of the Carquinez Strait is the City of Vallejo, which is located in southern Solano County. With an estimated 121,267 residents (US Census Bureau, 2020), Vallejo is among the largest cities in the Bay Area, and it is the largest city in Solano County. A zoning map (Figure F-3) from the City of Vallejo (2021) shows that the southern section of the city is largely residential, with sizeable commercial and public zones along I-80, a large amount of park and open space land (particularly along the southern waterfront), and industrial areas to the west along the Mare Island Strait.

Figure F-3 – City of Vallejo Zoning Map (excerpt)



The final community within close proximity to the Phillips 66 refinery is the City of Hercules, which lies just south of Rodeo and has an estimated population of 25,616 (US Census Bureau, 2020). The eastern and southern portions of the city have a significant amount of open space area while the central, northern, and western portions are largely residential and commercial (see Figure F-4).

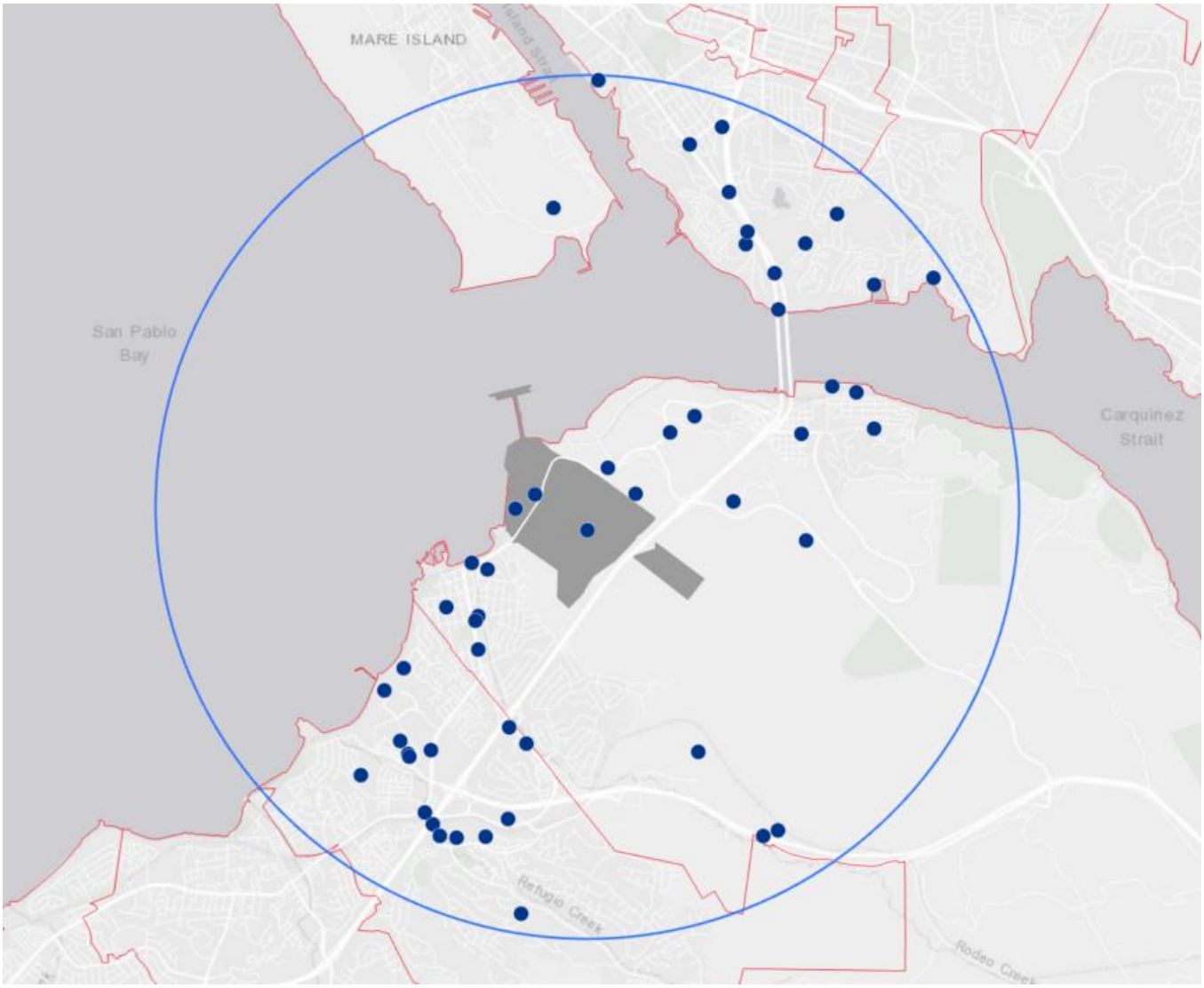
Figure F-4 – City of Hercules Zoning Map



Local Emissions Sources

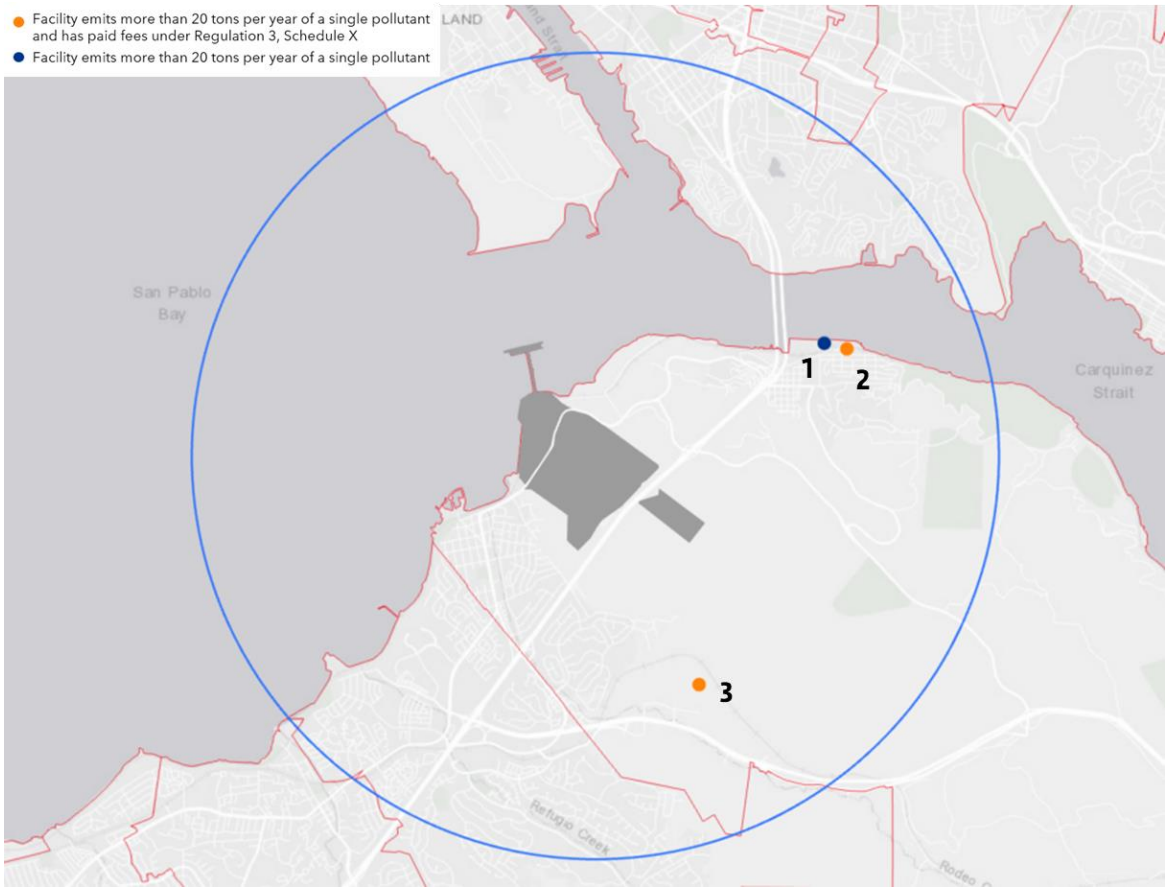
According to the Air District's database of regulated facilities, there are 51 permitted sources within a 5 km radius of the Phillips 66 refinery (Figure F-5). The Phillips 66 Refinery is the largest stationary source of air pollution in the area.

Figure F-5 – Permitted Facilities Near the Phillips 66 Refinery



To highlight some of the larger stationary sources of air pollution in the area, stationary sources with more than 20 tons per year of emissions of a single pollutant are shown in Figure F-6, and their emissions are summarized in Table F-1. Two of these facilities – the Phillips 66 Carbon Plant and Crockett Cogen – have paid major stationary source community air monitoring fees under Regulation 3, Schedule X. In addition to these stationary sources, other notable sources of emissions include Interstate 80 and marine vessels that travel through San Pablo Bay and the Carquinez Strait.

Figure F-6 –Stationary Sources Near the Phillips 66 Refinery Emitting More Than 20 Tons per Year of a Single Pollutant



1 – C & H Sugar Company
2 – Crockett Cogeneration(1)
3 – Phillips 66 Carbon Plant(1,2)

Notes: (1) The Phillips 66 Carbon Plant and Crockett Cogeneration both pay fees for Major Stationary Source Community Air Monitoring under Regulation 3, Schedule X. (2) Phillips 66 has proposed to modify the Rodeo Refinery into a repurposed facility that would renewable diesel fuel, renewable fuel gas, and renewable components for blending with other transportation fuels. Under this proposal, the Carbon Plant would no longer be necessary and would be demolished (Contra Costa County, 2021).

Table F-1 – Annual Emissions from Stationary Sources Near the Phillips 66 Refinery Emitting More Than 20 Tons per Year of a Single Pollutant(1)

Facility (CEIDARS ID)	Annual Emissions (tons/year)					
	CO	NOx	PM_{10}	$PM_{2.5}$	ROG	SOx
Phillips 66 Refinery (21359)	249.9	233.8	105.2	109.7	121.7	337.6
C & H Sugar (17315)	22.7	4.5	35.2	21.1	2.2	0
Crockett Cogen (8664)	23.8	84.1	12.5	12.5	3.9	4.8
Phillips 66 Carbon Plant (21360)	11.9	167.2	55.5	54.9	0.1	883.1

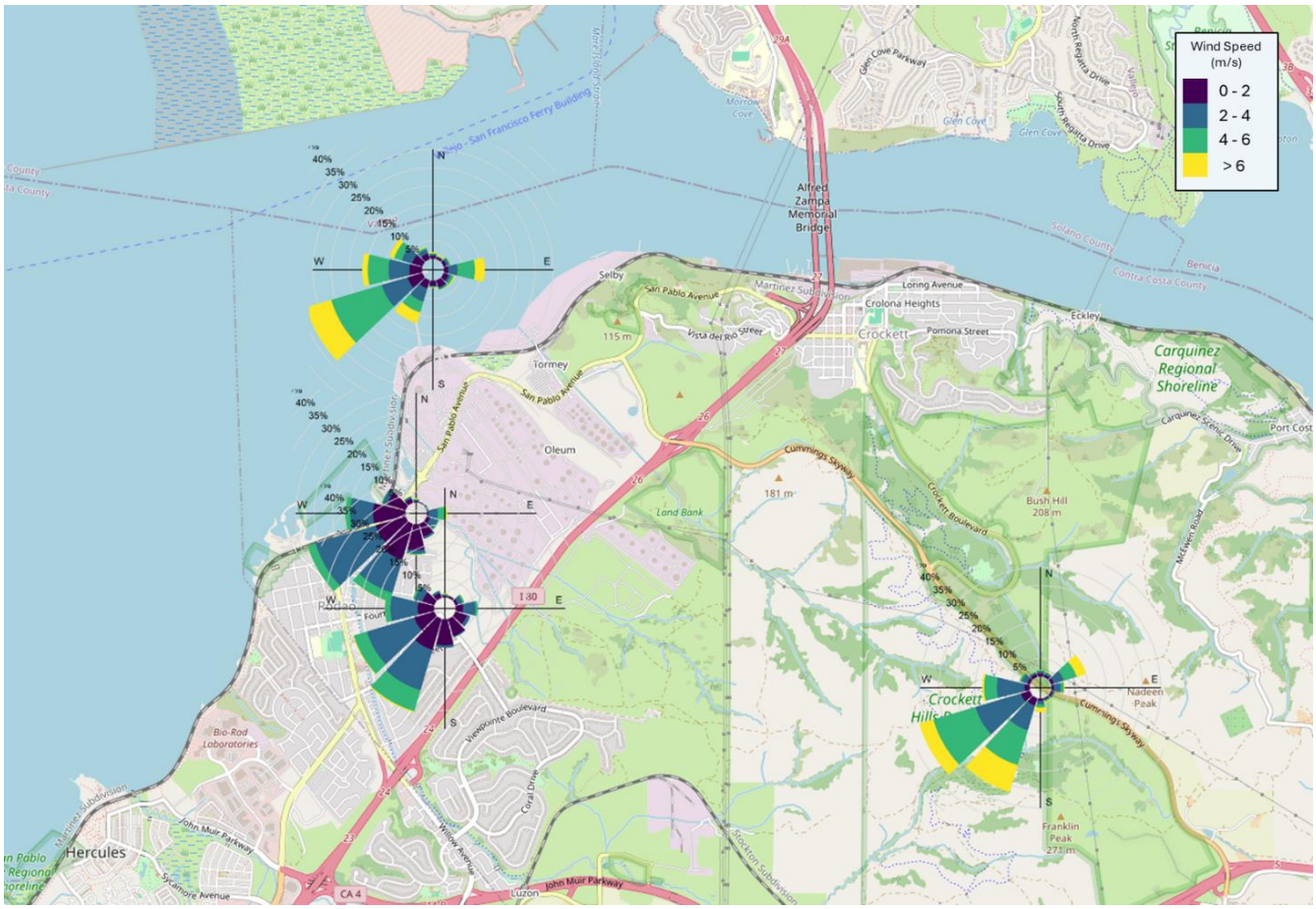
Notes: (1) Criteria pollutant emissions are for the 2021 reporting year, obtained from the California Emissions Inventory Data Analysis and Reporting System (CEIDARS).

Wind Climatology and Topography

The movement of air and topography (such as hills or valleys) significantly affect where emitted air pollutants end up and get concentrated. Therefore, when identifying potential locations for an air monitoring station to capture the effects of these emissions on ambient concentrations, it is necessary to consider historical wind patterns and topographical features in the area. In this case, the Air District performed a multi-year (2018 - 2022) analysis of wind data from refinery Ground-Level Monitors (GLMs) and stations affiliated with the National Oceanic and Atmospheric Administration (NOAA).[2]

Typical year-round wind patterns are summarized by the wind roses in Figure F-7. A wind rose shows the general wind direction and speed for a particular sampling period. The circular structure of the wind rose shows the direction the winds blew from, and the length of each "spoke" around the circle shows how often the wind blew from that direction. The different colors of each spoke provide details on the wind speed. Wind data from the stations shown illustrate that winds are predominantly from the southwest, consistent with prevailing onshore winds (from San Pablo Bay) that are common in the Bay Area. Offshore winds from the east also occur, but to a lesser extent than onshore winds. Overall, winds tend to be stronger near the shoreline and at elevation. Importantly, at any time of year, winds can vary considerably within an area over the course of a day.

Figure F-7 – Wind Roses for Nearby Meteorological Stations (2018-2022)



[2] Data from NOAA-affiliated meteorological stations were obtained through MesoWest: https://mesowest.utah.edu/

Winds also vary considerably by season and time of day, as shown in the wind rose plots in Figures F-8 through F-13. The spring, summer, and early fall seasons are characterized by onshore winds (winds from the southwest or off San Pablo Bay) that are strongest during the afternoon hours. In late fall and winter, winds typically switch periodically from onshore (from the southwest) to offshore (from the east or east-northeast) as storm systems move through the Bay Area. Winds from the southwest would tend to transport refinery-related emissions away from Rodeo and toward Crockett and southern Vallejo, while winds from the east or east-northeast may transport emissions into the northern part of Rodeo. Light winds (under 2 m/s) are also common, particularly overnight. Calm or light winds from variable directions can limit dispersion and allow pollutants to build-up in the local area.

Figure F-8 – Wind Roses for Winter (Dec-Jan-Feb 2018-2022)

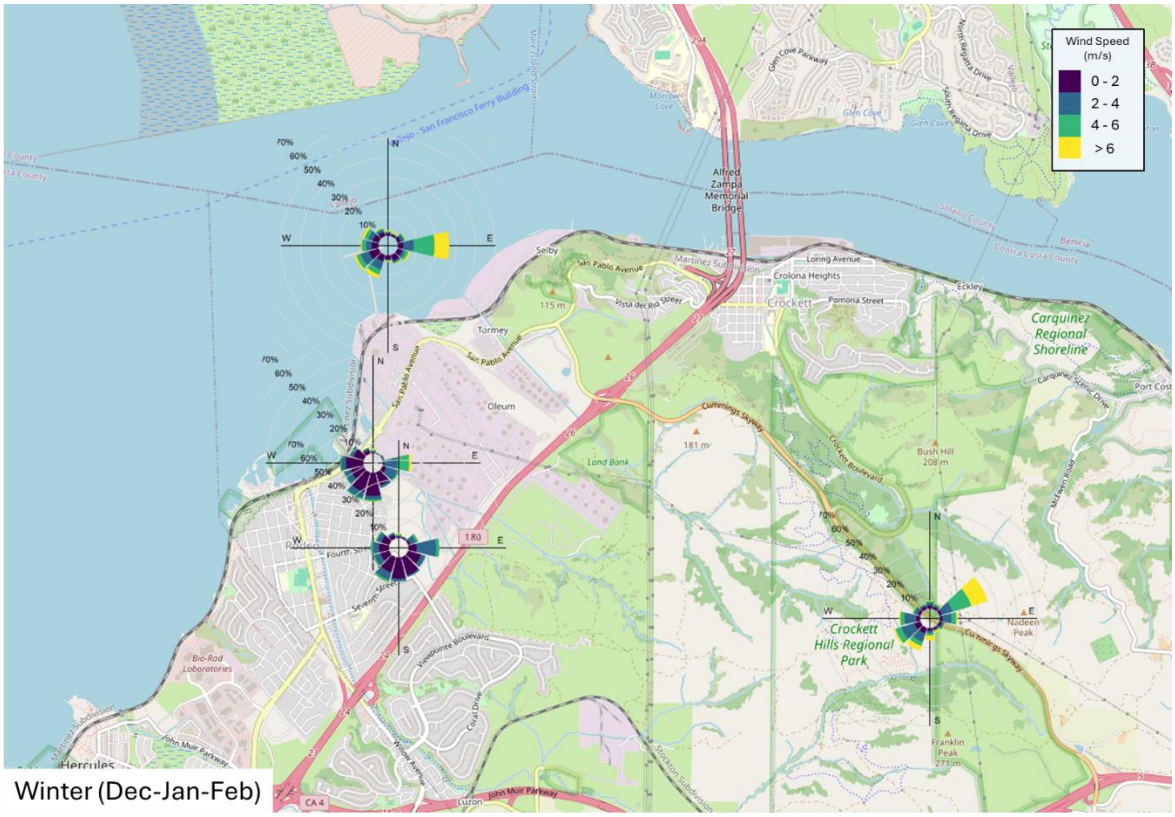


Figure F-9 – Wind Roses for Spring (Mar-Apr-May 2018-2022)

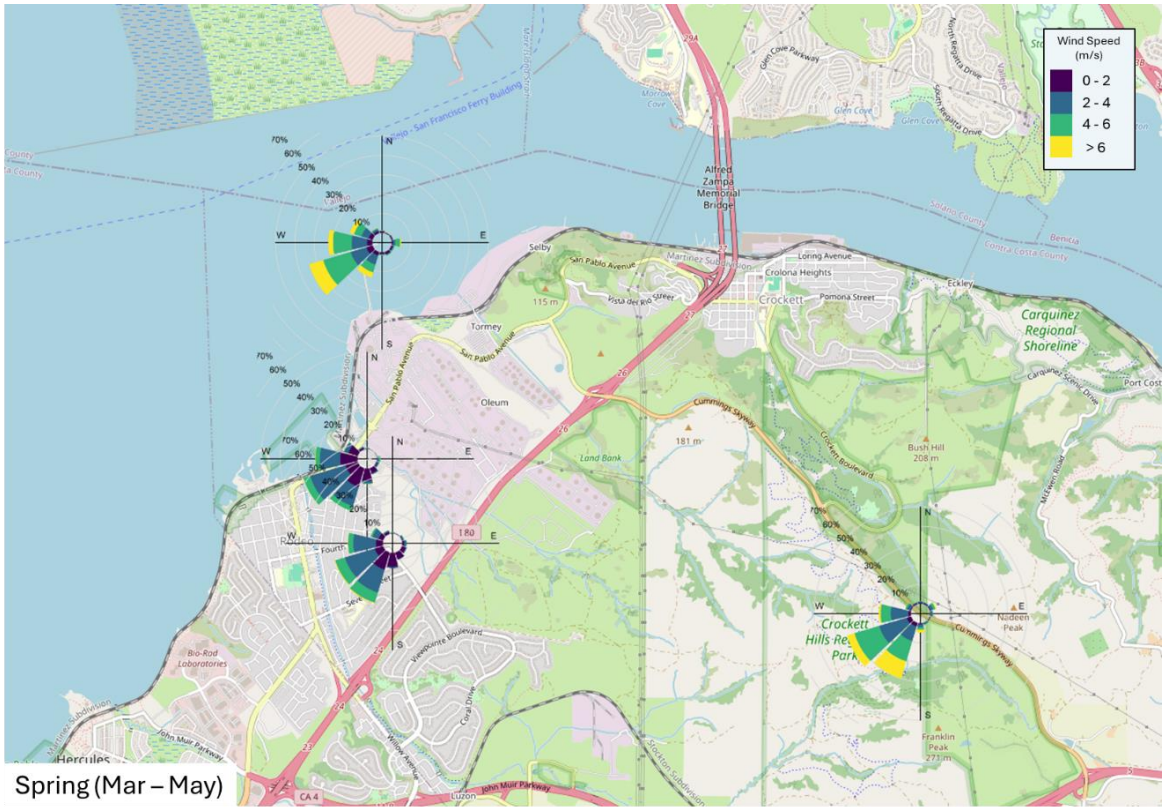


Figure F-10 – Wind Roses for Summer (Jun-Jul-Aug 2018-2022)

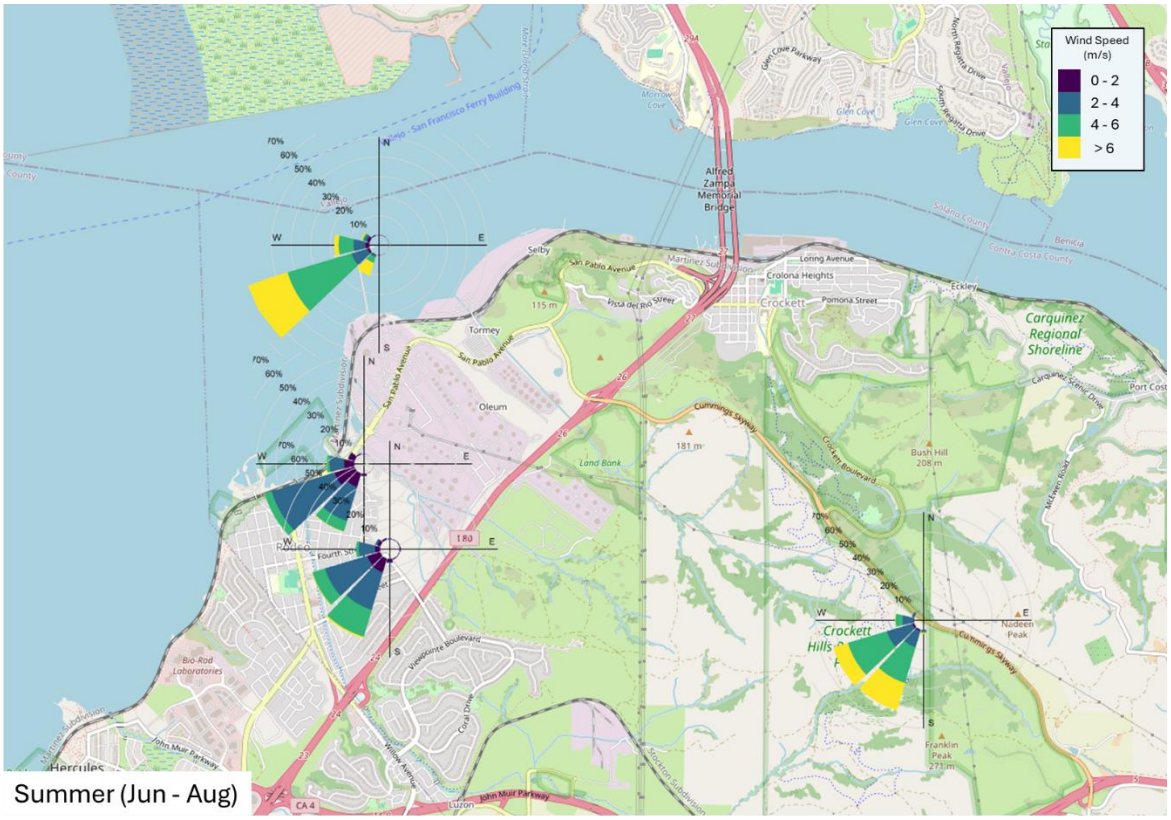


Figure F-11 – Wind Roses for Autumn (Sep-Oct-Nov 2018-2022)

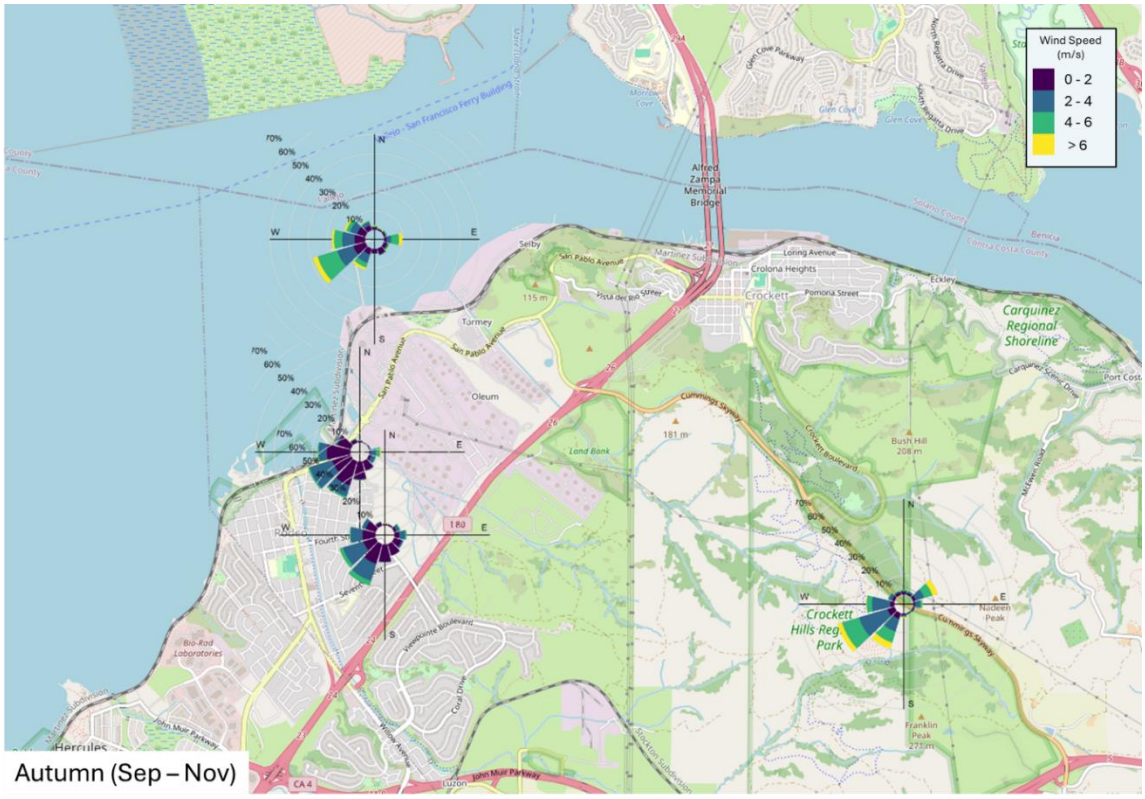


Figure F-12 – Wind Roses for Nighttime (2018-2022)

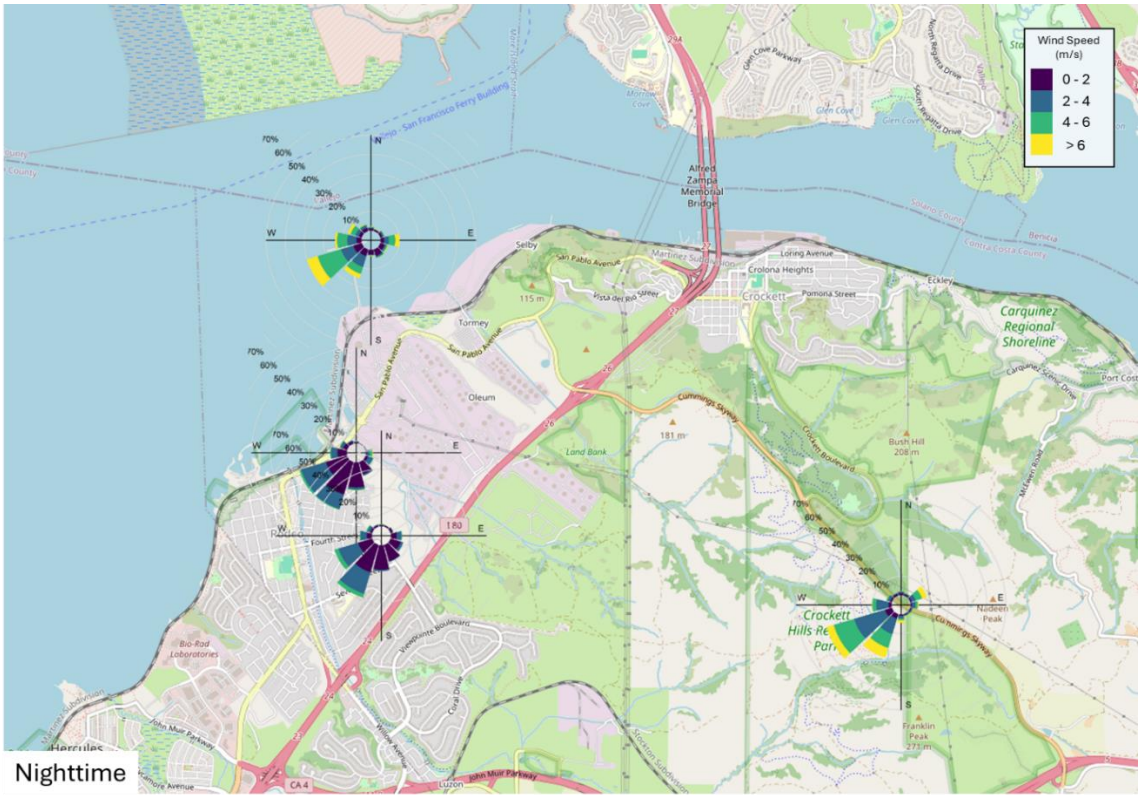
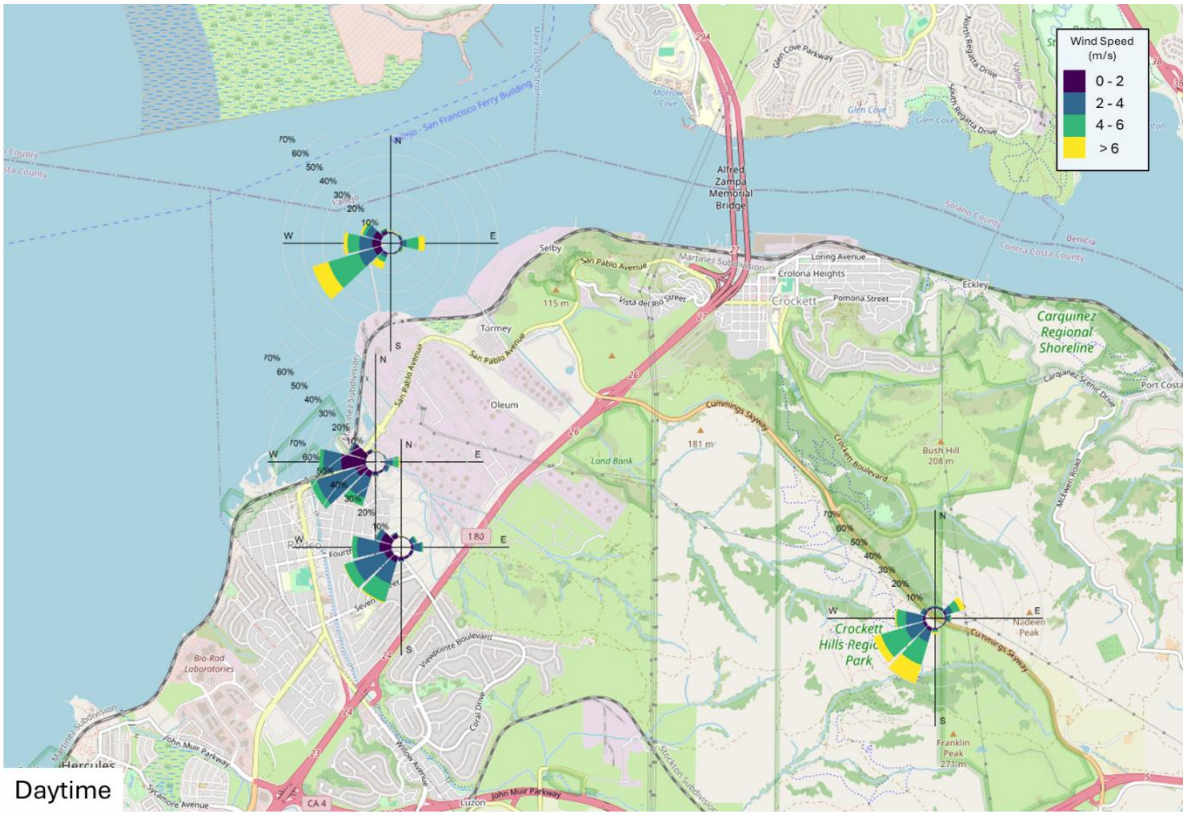


Figure F-13 – Wind Roses for Daytime (2018-2022)



While some wind patterns are driven by global or regional phenomena, topography can drive additional circulation at the local level, which may impact the dispersion and transport of pollution; the nature and degree of this impact depends on the specific arrangement of physical features in the area.

The shaded relief maps in Figure F-14 and Figure F-15 show complex terrain surrounding the Phillips 66 refinery. A prominent topographic adjacent to the facility is a ridge of coastal hills that runs diagonally along its northeast border from San Pablo Bay and extending inland. Interstate 80 cuts through this ridge and is flanked on the east by peaks around 425 to 550 feet in elevation. On the west side of I-80 and closer to the refinery, the hills are somewhat smaller, with a maximum peak of around 500 feet and additional peaks ranging from 200 to 400 feet in elevation. Topography can channel winds through narrow gaps, and it is possible that some emissions from the refinery (e.g., from vents and leaks near ground level) could be channeled along I-80 toward Crockett. It is also possible that emissions from tall stacks could flow directly over the hills, particularly near the shore where the peaks are lower. Emissions associated with the refinery's marine loading berths may also be directed toward Crockett and southern Vallejo when winds are blowing from the southwest.

Figure F-14 – Topography Around the Phillips 66 Refinery

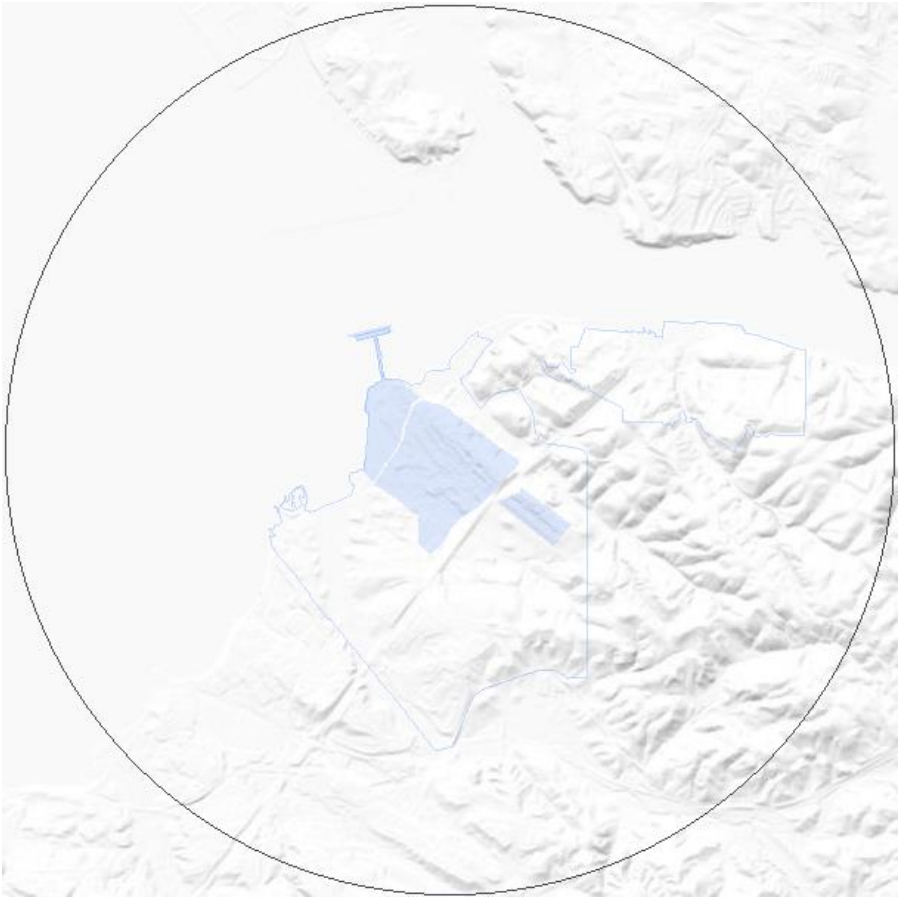
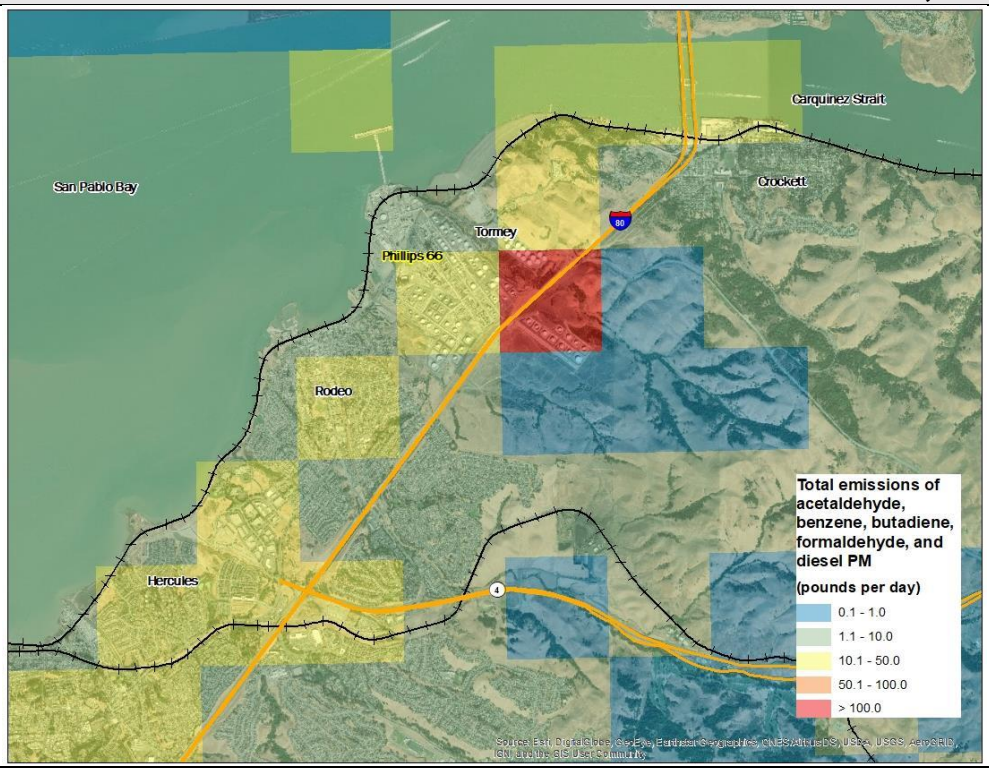


Figure F-15 – Topography Around the Phillips 66 Refinery

Health Risk Data, Sensitive Populations, and Environmental Justice Considerations

In an analysis for the Air District's Community Air Risk Evaluation (CARE)[3] project, estimated emissions of certain toxic air contaminants (TACs) from permitted stationary sources, on-road mobile sources, and distributed area sources in 2015 were allocated to a grid of cells with a spatial resolution of 1-km for use in cancer-risk modeling. This modeling effort found that five compounds (diesel PM, acetaldehyde, benzene, 1,3-butadiene, and formaldehyde) were responsible for more than 90% of the cancer risk attributed to emissions. The estimated combined TAC emissions of these compounds for the Rodeo-Crockett area are shown in Figure F-16. The greatest estimated emissions of TACs in the area are associated with the Phillips 66 Refinery. Elevated levels of TAC emissions are also indicated roughly along the I-80 corridor and along the Carquinez Strait due to transportation sources.

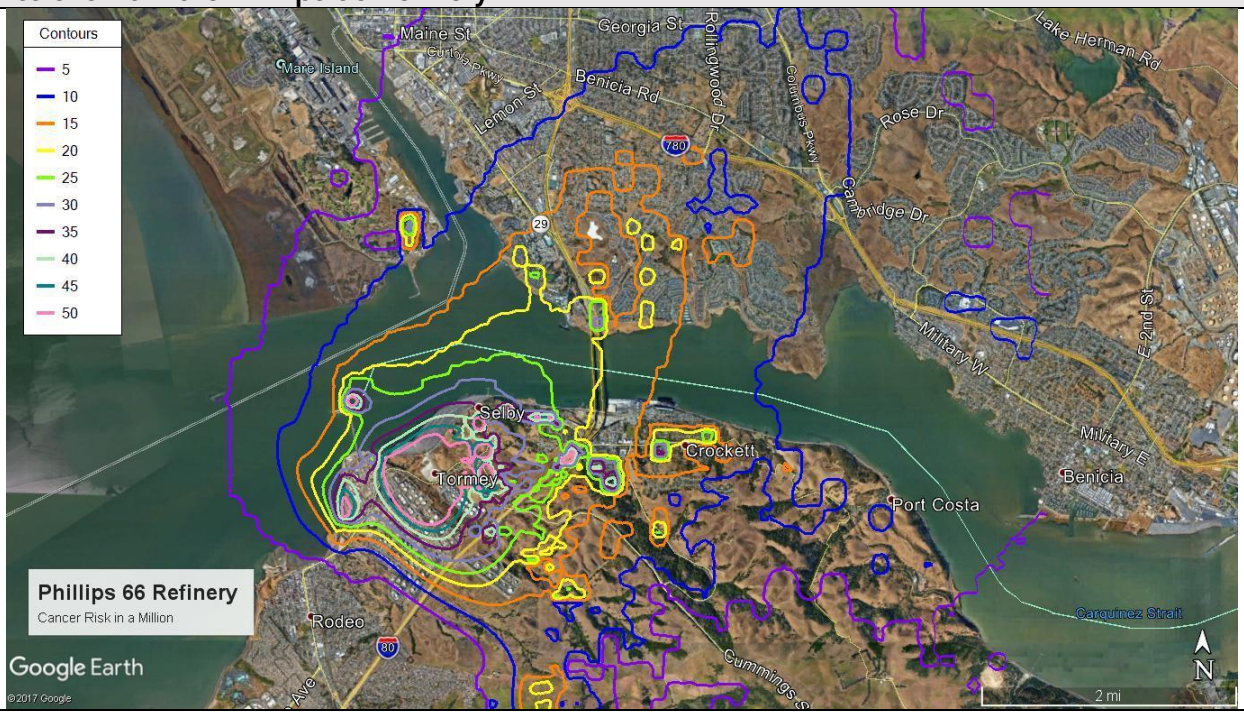
Figure F-16 – Estimated Emissions of Selected TACs in the Rodeo-Crockett Area (2015)



In a separate analysis, the Air District estimated health impacts from air contaminants by reviewing a Health Risk Screening Assessment (HRSA) from 2015 for the Rodeo-Crockett area using toxic emissions inventories provided by Bay Area refineries and meteorological data generated through AERMOD, to illustrate the locations of expected maximum impacts for a range of conditions and magnitude of those impacts. Figure F-17 shows the estimated cancer risk (in one million) for the area due to emissions from the Phillips 66 Refinery. The contours generally exhibit an egg- or cone-shaped pattern extending from the refinery toward Crocket and Vallejo, consistent with the prevailing wind direction. The areas with relatively greater estimated elevated cancer risk (above 25 in a million) include the refinery itself, portions of Rodeo north of the refinery, portions of Crockett, and far southern Vallejo. Relatively lower estimated cancer risk is depicted in most of Rodeo south of the refinery, which corroborates observational wind data discussed previously. The Air District will be conducting a new air toxics evaluation for Phillips 66 under Rule 11-18, but that work is not expected to impact the general results of this analysis for the community air monitoring station.

[3] Website for the Air District's CARE Program: https://www.baaqmd.gov/community-health/community-health-protection-program/community-air-risk-evaluation-care-program

Figure F-17 – Estimated Cancer Risk (in one million) from a 2015 Health Risk Assessment of Emissions from the Phillips 66 Refinery



When considering the health impacts from air pollution, it is also instructive to consider biological traits, health status, or other community characteristics that can result in increased vulnerability to pollution. A number of these population characteristics have been incorporated into the CalEnviroScreen (CES)[4] model (version 4.0), which identifies California communities by census tract that are disproportionately burdened by, and vulnerable to, multiple sources of pollution. CalEnviroscreen uses 21 statewide indicators to characterize pollution burden and population characteristics. Individual indicator scores are provided along with composite scores based on a specified formula. The population characteristics used by CalEnviroScreen are: emergency department visits associated with asthma, cardiovascular disease (emergency department visits for heart attacks), low birth-weight infants, educational attainment, housing-burdened low-income households, linguistic isolation, poverty, and unemployment. The percentiles for the Rodeo, Crockett, and Vallejo areas (compared to all census tracts in the state) are shown in Figure F-18 and Table F-2.

The communities of Rodeo, Crockett, and Vallejo are split among multiple census tracts. Western Rodeo (where most of Rodeo's population resides) and western Crockett are together in the same census tract while eastern Rodeo and central/eastern Crockett (where most of Crockett's population resides) are each in separate tracts. The City of Vallejo has multiple census tracts, five of which intersect the 5 km buffer around the Phillips 66 refinery. For this portion of the analysis, the focus will be on the census tracts that are labeled 1, 2, and 3 in Figure F-18.

In general, tract 3 (central/eastern Crockett) has lower scores (less overburdened) than tract 1 (southwest Vallejo) and tract 2 (western Rodeo/western Crockett). The exception is for the rate of low birth-weight infants, in which case tracts 2 and 3 are both between the 80th and 90th percentiles. However, tract 1 still ranks higher than tracts 2 and 3 as it falls above the 90th percentile. For the remaining indicators, tract 1 is ranked higher for cardiovascular disease while tract 2 is ranked higher for education, poverty and unemployment. Tracts 1 and 2 are in the same percentiles for asthma, housing burden, and linguistic isolation.

[4] Website for CalEnviroScreen 4.0: https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40

Figure F-18 – Percentiles for CES Composite Score and Selected CES Indicators in Census Tracts Near the Phillips 66 Refinery

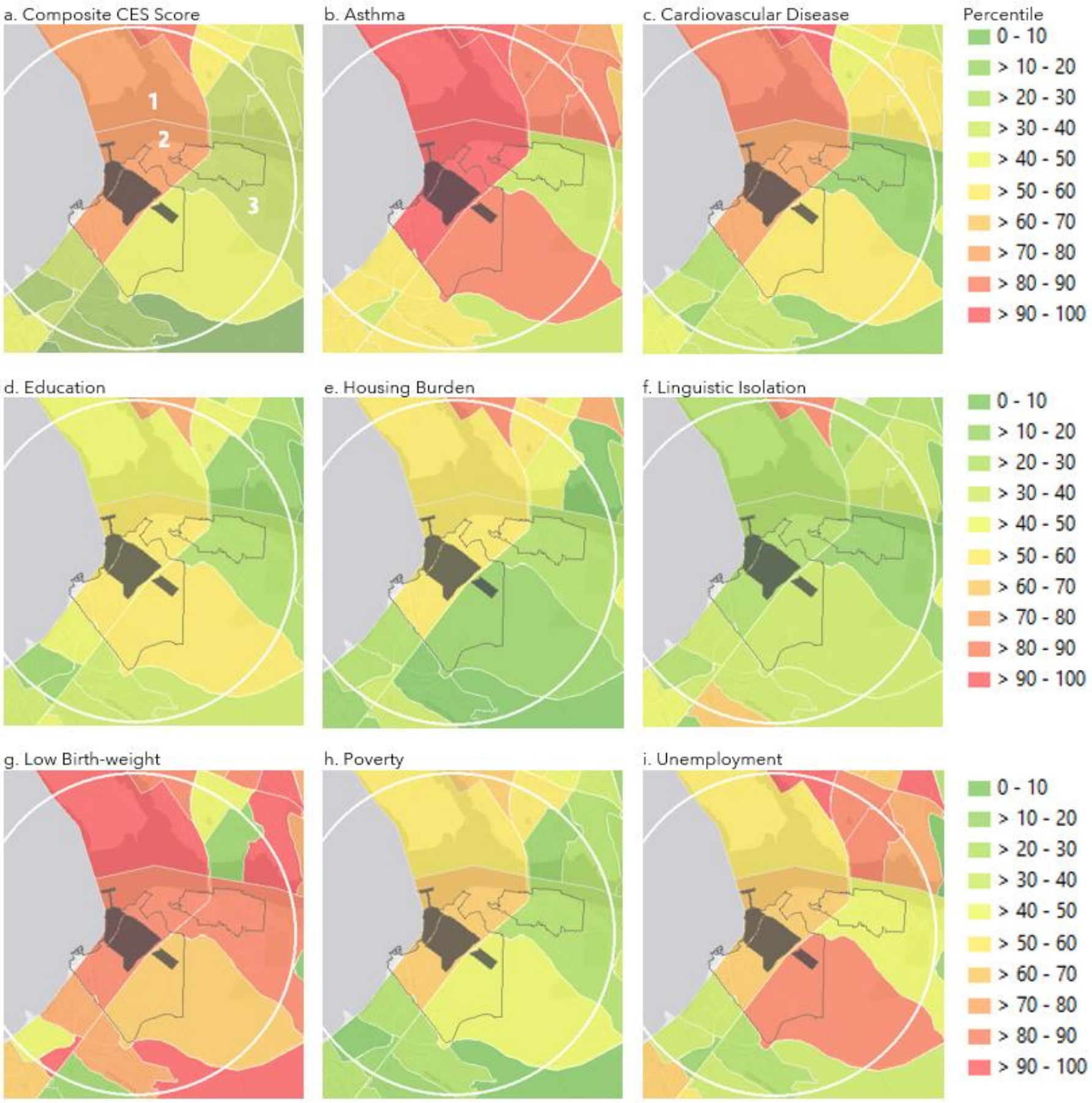


Table F-2 - Percentiles for CES Composite Score and Selected CES Indicators in Census Tracts Near the Phillips 66 Refinery

Indicator	Percentile		
	Tract 1 (Southwest Vallejo)	**Tract 2 (Western Rodeo/Crockett)**	**Tract 3 (Central & Eastern Crockett)**
Composite CES Score	80-90	80-90	30-40
Asthma	90-100	90-100	30-40
Cardiovascular Disease	80-90	70-80	10-20
Education	40-50	50-60	20-30
Housing Burden	50-60	50-60	20-30
Linguistic Isolation	20-30	20-30	10-20
Low Birth-weight	90-100	80-90	80-90
Poverty	50-60	60-70	20-30
Unemployment	50-60	60-70	40-50

Air Monitoring Stations & Monitoring Data

The locations of existing air quality monitors and historical data from those monitors are important considerations when establishing new monitoring sites. Table F-3 summarizes the recent history of air monitoring in the Rodeo, Crockett, and Vallejo areas, and Figure F-19 shows the location of monitoring stations.

The Phillips 66 refinery began measuring hourly SO_2 and H_2S readings in 1996, and then 1-minute readings in 2013 as part of its Ground-Level Monitoring (GLM) network. This type of monitoring is required at all five Bay Area refineries by Air District Regulation 9, Rule 1 and Regulation 9, Rule 2.[5,6] The Air District oversees the monitoring conducted by the refineries, including conducting site evaluations and performance audits of the monitors. Measurements in excess of rule limits are reviewed by meteorologists and investigated by Compliance and Enforcement staff. Currently, the Phillips 66 refinery operates five stations that monitor SO_2 and four that monitor H_2S. Meteorological monitoring is currently performed at three stations. In addition to the refinery GLM network, the Air District operates three monitoring stations in the area: one in Crockett, which monitors SO_2 and air toxics; one in Rodeo, which monitors H_2S only; and one in Vallejo, which monitors CO, NO_2, O_3, SO_2, $PM_{2.5}$, speciated $PM_{2.5}$, and air toxics.[7]

Table F-3 – Air Quality Monitoring Near the Phillips 66 Refinery

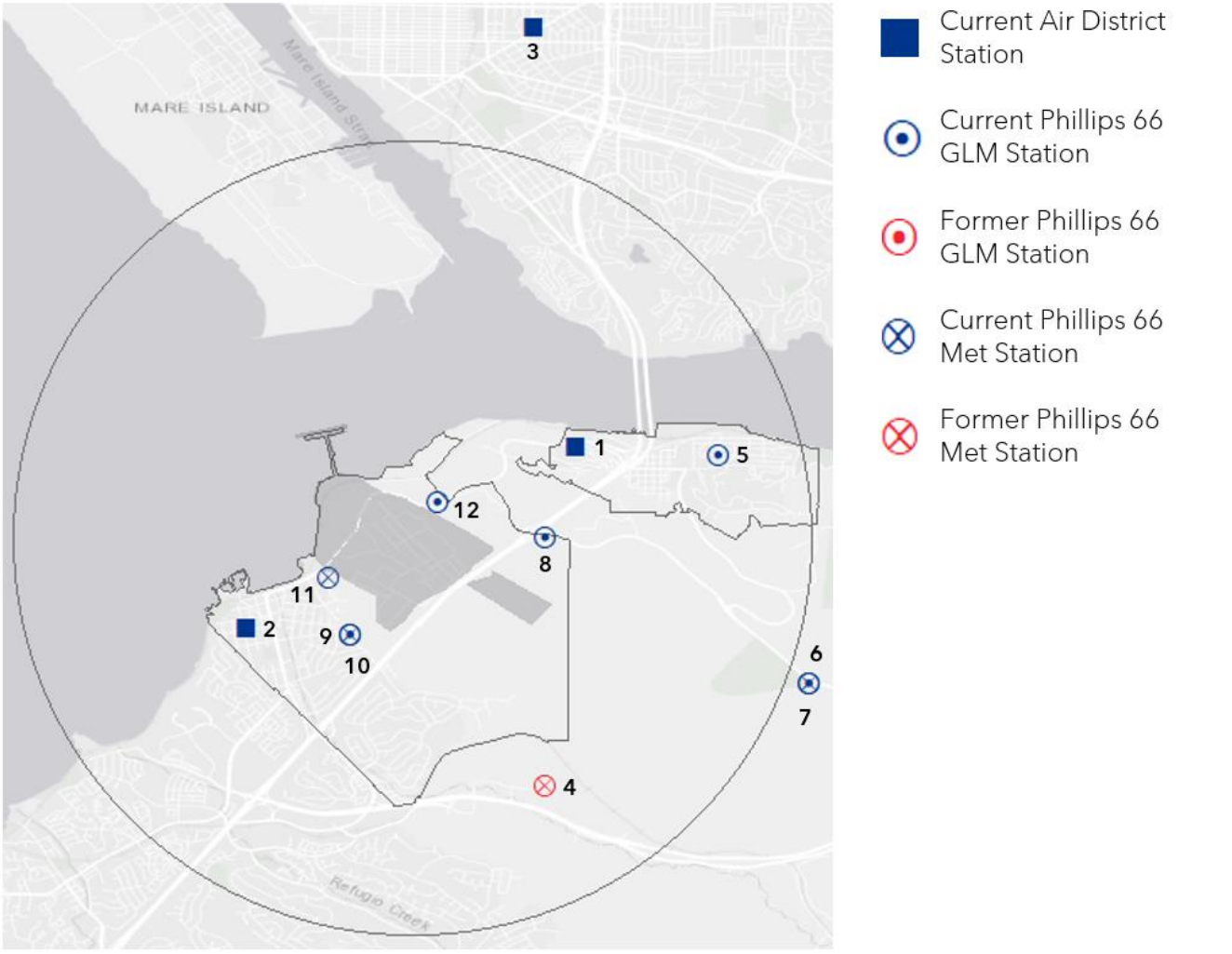
Station (map label)	Operator	Parameters Measured
AQMD-Crockett (1)	BAAQMD	SO_2
		Air Toxics
AQMD-Rodeo (2)	BAAQMD	H_2S
AQMD-Vallejo (3)	BAAQMD	CO, NO_2, O_3, SO_2
		Air Toxics
		Speciated $PM_{2.5}$
		$PM_{2.5}$
Phillips-Carbon (4)	Phillips 66	Meteorology
Phillips-Crockett (5)	Phillips 66	H_2S, SO_2
Phillips-Cummings Skyway (6, 7)	Phillips 66	SO_2
		Meteorology
Phillips-East Refinery (8)	Phillips 66	H_2S, SO_2,
Phillips-Hillcrest (9, 10)	Phillips 66	H_2S, SO_2, Meteorology
Phillips-Rodeo (11)	Phillips 66	Meteorology
Phillips-Tormey (12)	Phillips 66	H_2S, SO_2,

[5] Air District Regulation 9, Rule 1: Sulfur Dioxide: https://www.baaqmd.gov/rules-and-compliance/rules/reg-9-rule-1-sulfur-dioxide

[6] Air District Regulation 9, Rule 2: Hydrogen Sulfide: https://www.baaqmd.gov/rules-and-compliance/rules/reg-9-rule-2-hydrogen-sulfide

[7] Although the Vallejo monitoring station is outside of the 5-km buffer around the Phillips 66 refinery, data from that station are included in the analyses below for reference.

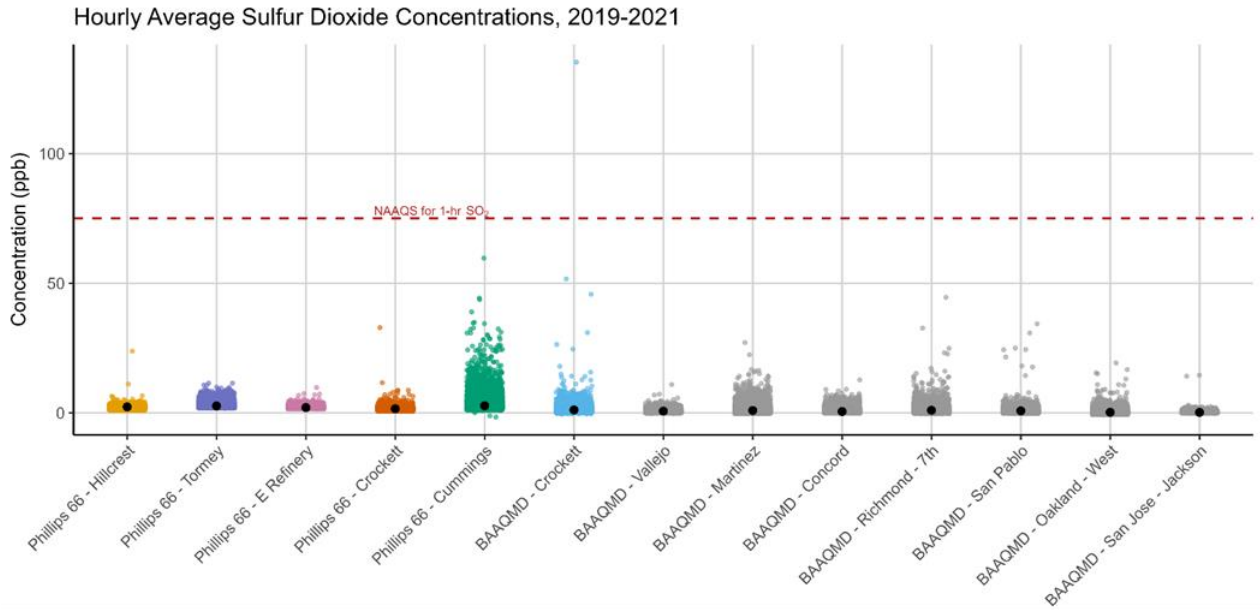
Figure F-19 – Location of Current and Historical Monitoring Stations Near the Phillips 66 Refinery

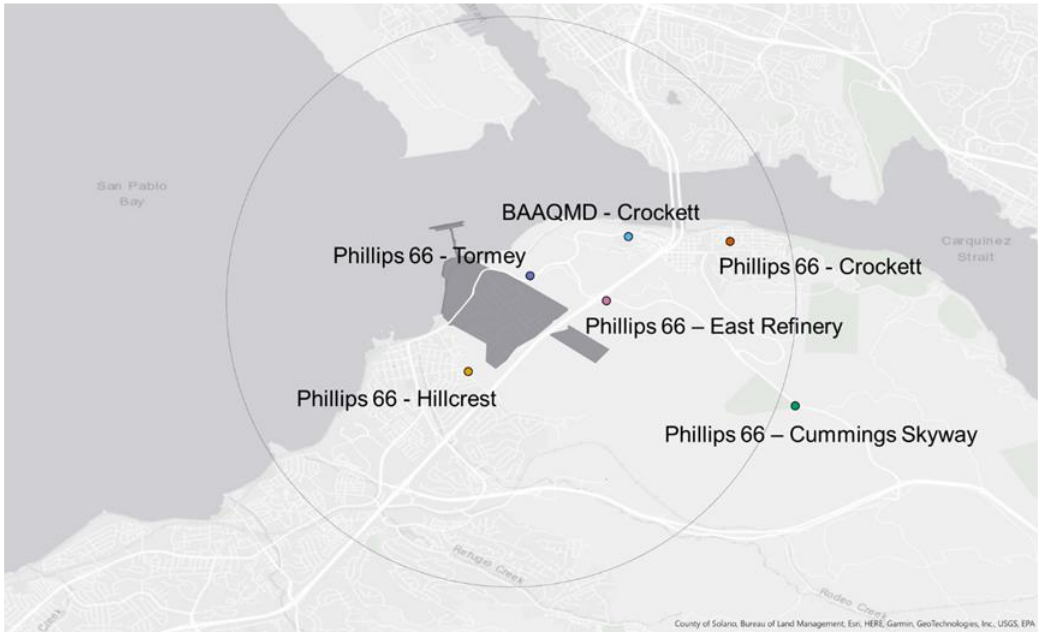


Notes: 1) See Table F-3 for the names corresponding to the numbered labels

A review of historical hourly SO_2 and H_2S measurements at air monitoring stations around the Phillips 66 refinery over the period 2019 to 2021 shows that while concentrations have been low generally, variability is noted among the stations and occasional higher concentrations do occur. Figure F-20 shows distributions of hourly SO_2 concentrations by monitoring station, where each smaller dot represents an hourly SO_2 concentration, and the larger black dot represents the three-year average concentration. The data distributions are color-coded to match the station locations on the accompanying map.

Figure F-20 – Historical SO_2 Concentrations and Map of SO_2 Monitor Locations

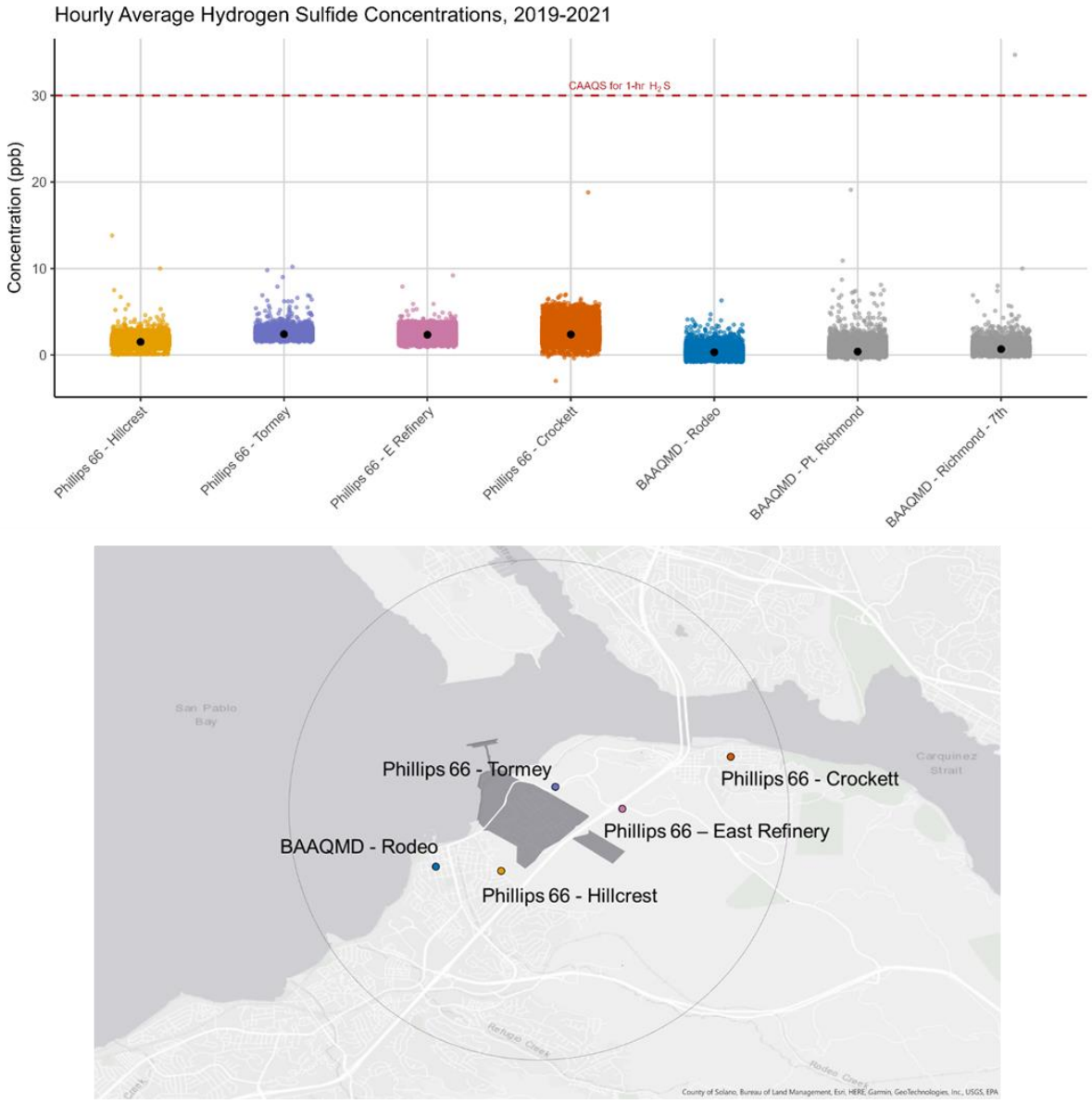




There were more occurrences of relatively higher SO_2 concentrations at the Phillips 66 – Cummings Skyway GLM compared to other monitors. With winds commonly from the west-southwest, the Cummings Skyway GLM is often downwind of the Phillips Carbon Plant. A fewer number of relatively higher concentrations of SO_2 also occurred at the Air District's Crockett monitor, including one measurement in excess of the National Ambient Air Quality Standard (NAAQS) for 1-hour SO_2 of 75 ppb. While the Air District's Crockett monitoring station satisfies federal quality assurance requirements under 40 CFR Part 58, Appendix A, it does not satisfy siting criteria under 40 CFR Part 58, Appendix E. As a result, data from this station can be compared with the NAAQS but the station cannot be used to satisfy federal minimum monitoring requirements. Refinery GLMs are not subject to the NAAQS since. There were fewer occurrences of higher SO_2 concentrations at the other monitors. Data from the Oakland West monitoring station (near the Port of Oakland) and the San Jose-Jackson (urban area without refinery or port related SO_2 sources) are also shown for context.

Figure F-21 is similar to the previous figure but shows measured hourly H_2S concentrations. While H_2S is not a criteria pollutant regulated under the Clean Air Act, CARB has established a California Ambient Air Quality Standard (CAAQS) for 1-hr hydrogen sulfide of 30 ppb for the purpose of odor control, though some people may detect odors at lower concentrations. Hourly H_2S concentrations at the refinery ground-level monitors and Air District monitoring stations over the 2019 to 2021 period were all below 30 ppb. In general, most of the H_2S measurements were below 5 ppb, with infrequent occurrences of relatively higher concentrations noted at most monitors.

Figure F-21 – Historical H_2S Concentrations and Map of H_2S Monitor Locations



The Air District measures selected volatile organic compounds (VOCs), many of which are TACs, at its nearby Crockett and Vallejo monitoring stations. These VOCs are measured by collecting air into a canister over 24 hours, and the collected samples are then analyzed at the Air District's laboratory. VOC samples are collected at these monitoring stations every twelfth day. VOCs can come from many kinds of facilities, operations, processes, and consumer products, as well as smoke from wildfires and other combustion.

Measurements for selected VOCs from Air District monitoring stations from 2016 to 2020 are provided in Figure F-22 (benzene), Figure F-23 (toluene), Figure F-24 (1,3-butadiene), and Figure F-25 (chloroform). Benzene and 1,3-butadiene are among the five compounds found to be responsible for more than 90% of the cancer risk attributed to emissions as part of the previously mentioned CARE study. Toluene shares similar sources to benzene and is now often used as a replacement for benzene in certain products, such as solvents.

Most of the measured benzene concentrations have been below 0.5 ppb across the Air District's monitoring network (Figure F-22), which is below the California Office of Environmental Health Hazard's chronic Reference Exposure Level (REL) for benzene of 1 ppb. Most measurements above 1 ppb occurred during periods of wildfire smoke. Some monitoring stations, including San Pablo, have recorded instances of relatively higher benzene concentrations (over 0.5 ppb) outside of periods of wildfire smoke, possibly indicating contributions from local emissions of benzene. Average benzene concentrations were slightly lower at the Richmond-7th St. monitoring station compared to the San Pablo monitoring station, and there were comparatively fewer individual measurements of higher levels of benzene at the Richmond-7th St. monitoring station.

Some monitoring stations, including Vallejo, recorded more occurrences of relatively higher toluene concentrations compared to other stations in the network (Figure F-23), possibly indicating greater contributions from local emissions of toluene in those locations. Measured toluene concentrations at the Crockett monitoring station were relatively low compared to other locations. While benzene and toluene share similar sources, toluene is now often used as a replacement for benzene in certain products, such as solvents. Although some of toluene concentrations measured at the Vallejo monitoring station were higher than in other urban areas, they were well below OEHHA's chronic and acute reference exposure levels (RELs) of 110 ppb and 1300 ppb, respectively.

Most of the 1,3-butadiene samples (over 89% at Vallejo and over 97% at Crockett) yielded no detectable concentration. Of the few samples with detectable levels of 1,3-butadiene, most concentrations were less than 0.2 ppb (Figure F-24). Several monitoring stations, such as San Jose – Jackson, San Jose – Knox, Oakland West, and Vallejo (among others) had more frequent occurrences of relatively higher concentrations of 1,3-butadiene. While 1,3-butadiene emissions result from petroleum refining operations, the bulk of 1,3-butadiene in the atmosphere comes from traffic, which is ubiquitous in the Bay Area urban environment.

The two highest concentrations of chloroform measured throughout the Air District's monitoring network from 2016-2020 were at the Crockett monitoring station. Both samples were from December 2016. Some typical sources of chloroform in the air include chlorination of drinking water and wastewater, pulp and paper mills, hazardous waste sites, and sanitary landfills. It is unclear what the source of the relatively higher concentrations of chloroform were in this case.

Figure F-22 – Historical Benzene Concentrations

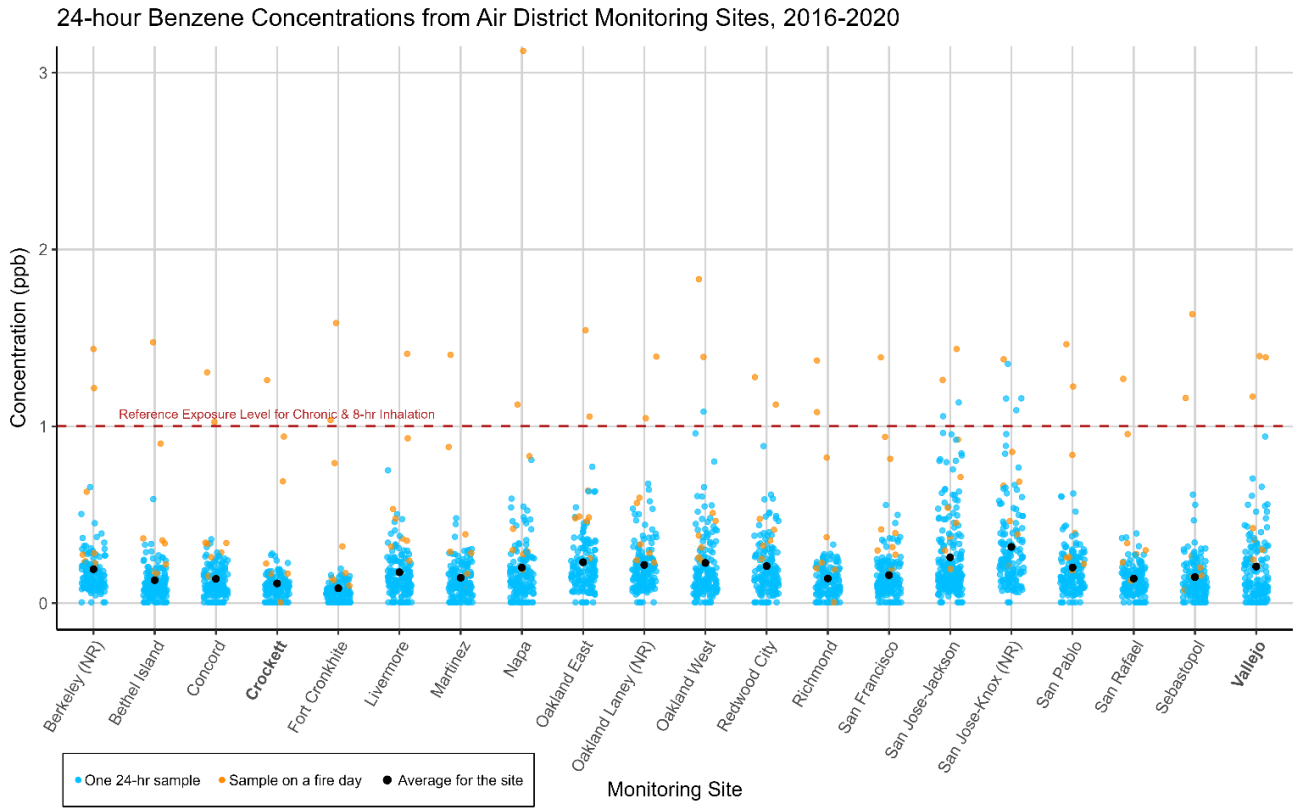


Figure F-23 – Historical Toluene Concentrations

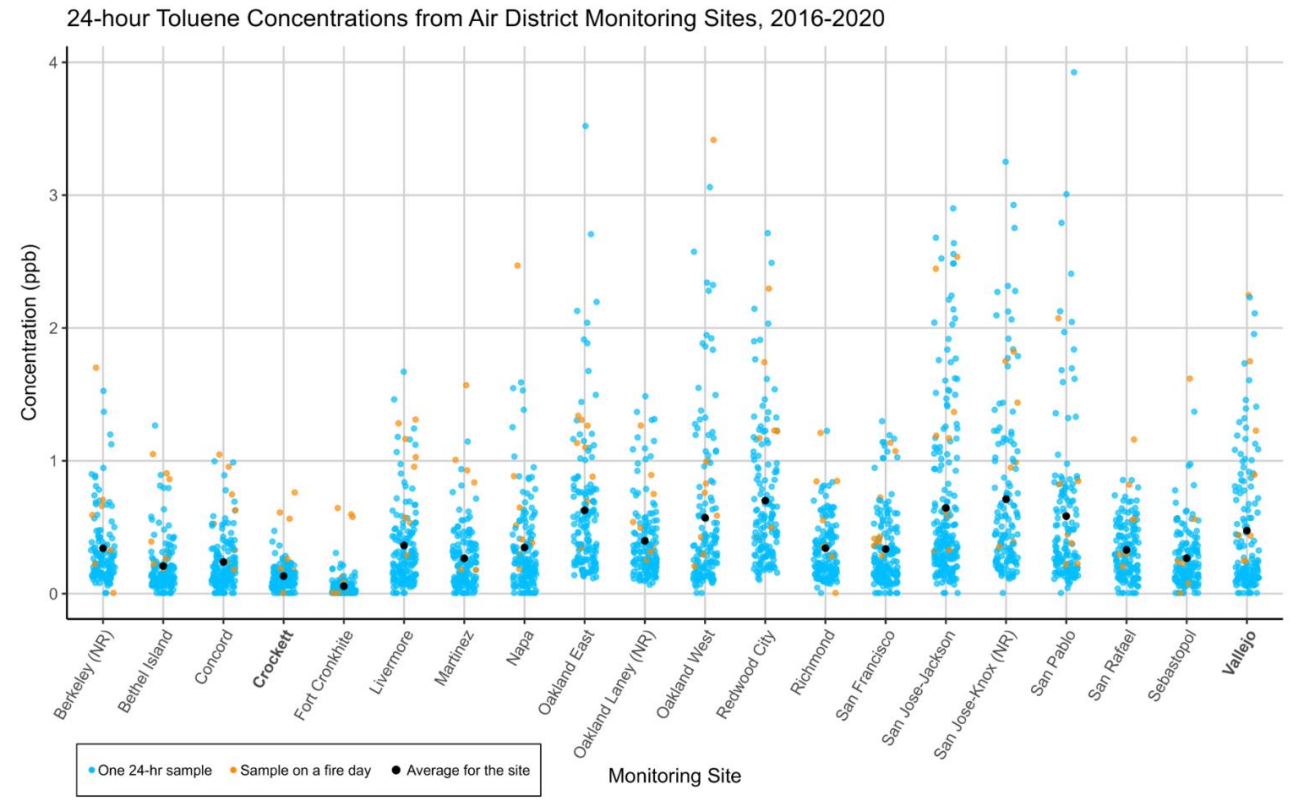


Figure F-24 – Historical 1,3-Butadiene Concentrations

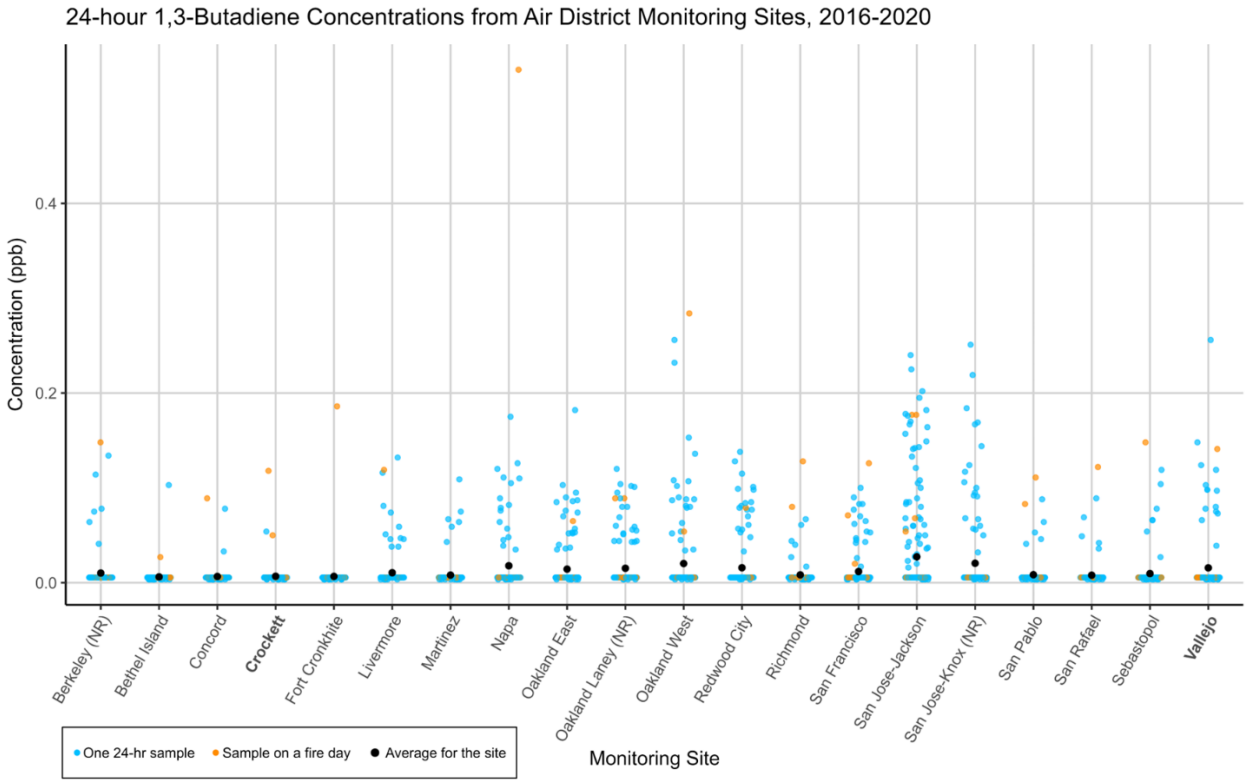
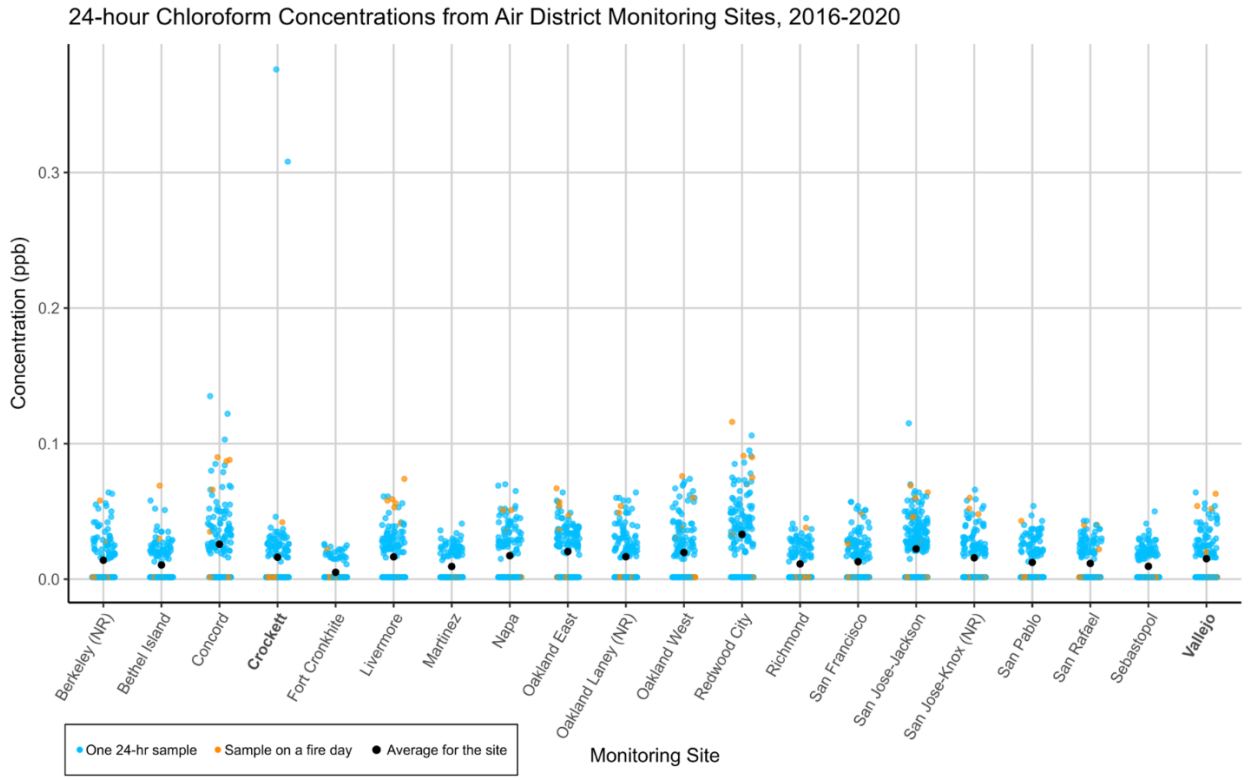


Figure F-25 – Historical Chloroform Concentrations



Stakeholder Input

The Air District responds to and investigates all air pollution complaints. Air District staff reviewed complaint data between January 1, 2019, and December 31, 2023, for the following zip codes around the Phillips 66 Refinery: 94525, 94547, 94564, 94569, 94572, 94590, 94591, and 94592. During this period, the Air District received 724 complaints in these zip codes. Table F-4 shows a breakdown of the number of complaints by zip code and by complaint type. Based on the data, there were 160 complaints (primarily odor-related) associated with the Phillips 66 Refinery. A number of Phillips 66-related complaints were recorded for the same event, including the 2/23/2021 H_2S release (11 complaints) and the 4/11/2023 flaring event (17 complaints).

Table F-4 – Complaints by Zip Code and Type between January 1, 2019 and December 31, 2023

Zip Code	Asbestos	Dust	Indoor Fire	Outdoor Fire	Gas Station Nozzle	Gas Station Other	Odor	Other	Smoke	Train	Total
94525	1	7	2	2	0	0	482	9	7	0	510
94547	0	2	0	1	1	0	17	0	2	0	23
94564	0	0	0	0	0	0	14	0	3	1	18
94569	0	0	0	0	0	0	1	1	1	0	3
94572	0	1	0	2	0	0	61	20	18	0	102
94590	0	2	0	2	1	0	34	0	5	0	44
94591	1	2	0	3	0	1	14	1	0	0	22
94592	0	2	0	0	0	0	0	0	0	0	2
Total	2	16	2	10	2	1	623	31	36	1	724

Figure F-26 shows suggested locations (green marker) for future air monitoring as proposed by community members at a workshop held in Rodeo in March 2018. Only one location, in central Crockett, was suggested at that meeting.

Figure F-26 – Monitoring Locations Suggested by Community Members in 2018

Recommended Priority Search Area for the Phillips 66 Major Stationary Source Community Air Monitoring Station

As noted in the Executive Summary, no single fixed monitoring location will capture all the emissions from a given facility. Variability in the meteorological conditions coupled with differences in the characteristics (e.g., temperature or height) of emissions mean there is a chance that any area nearby could experience the impacts of the facilities, particularly for short duration emissions or incidents. In this case, several key factors stand out:

- Prevailing winds are from the southwest, which would tend to transport refinery-related pollutants toward Crockett and southern Vallejo, but winds from the east or northeast also occur, which may transport pollutants into Rodeo.
- Consistent with the prevailing wind data, a health risk screening assessment shows estimated cancer risk contours extending from the refinery toward Crocket and Vallejo.
- A review of historical measured concentrations of different pollutants at existing air monitoring stations have been relatively low.
    - The Phillips 66-Cummings Skyway GLM measured more occurrences of relatively higher concentrations of SO_2, but this monitor is in a generally unpopulated area downwind of the Phillips Carbon Plant.
    - The Air District's Vallejo monitoring station measured more occurrences of relatively higher concentrations of certain air toxics, such as benzene and 1,3-butadiene, compared to the Air District's Crockett monitoring station. These pollutants have many sources, and the higher concentrations measured at the Vallejo monitoring station are likely reflective of heavier traffic and aggregate emissions of numerous smaller pollution sources in Vallejo, compared to the Crockett monitoring station which is usually upwind of I-80.
- Sizeable stationary sources in the area other than the refinery include C & H Sugar and Crockett Cogeneration; both are located in Crockett, and Crockett Cogeneration is also subject to fees under Regulation 3, Schedule X.
- The census tract that overlaps with Rodeo has a higher score as an overburdened community (CalEnviroScreen composite score over the 80th percentile) compared to the census tract that overlaps with Crockett.

On balance, these factors support two options for recommended search areas for establishing a new Major Stationary Source Community Air Monitoring station:

1. In Rodeo, southwest of the refinery. Rodeo is the community nearest to the refinery and the census tract it overlaps with has a high score as an overburdened community (CalEnviroScreen composite score of 87%). While prevailing winds are from the southwest and may transport refinery-related emissions away from central Rodeo, periods of easterly or northeasterly winds also occur, which may transport emissions into the northern part of Rodeo. In addition, periods of light and variable winds may allow emissions to build up locally in communities nearest the refinery, such as Rodeo. Thus, the recommended search area encompasses the parts of Rodeo that are nearest to the refinery fenceline, which includes the Bayo Vista community immediately adjacent to the fenceline. Should a new air monitoring station be established in Rodeo, the existing Air District monitoring station in Rodeo (which measures only H_2S) should be considered for closure as measured concentrations there have been low overall, and the existing station would be redundant with a new station nearby.

2. In Crockett, east of I-80. While Crockett is not as near to the refinery compared to Rodeo, prevailing winds from the southwest may transport refinery-related emissions toward Crockett. The recommended search area in Crockett includes generally the more densely populated sections of Crockett, which are largely east of I-80. Should a new air monitoring station be established in Crockett, the existing Air District monitoring station in Crockett should be considered for closure as measured concentrations there have been low overall, and the existing station would be redundant with a new station nearby. Additionally, while the existing Air District monitoring station in Crockett satisfies federal quality assurance requirements under 40 CFR Part 58, Appendix A, it does not satisfy siting criteria under 40 CFR Part 58, Appendix E. As a result, data from this station can be compared with the NAAQS but the station cannot be used to satisfy federal minimum monitoring requirements.

While either search area may be suitable for establishing a new community air monitoring station, it is recommended to proceed first with the search area in Rodeo, given its closer proximity to the refinery and higher score as an overburdened community. When resources allow, subsequent monitoring at a new location within the recommended search area in Crockett should also be considered.