

The logo for CTEH, consisting of the letters 'CTEH' in a bold, white, sans-serif font with a registered trademark symbol (®) to the upper right, all contained within a dark blue rectangular background.

**CTEH**®

THE SCIENCE OF READY<sup>SM</sup>

**VALERO ENERGY**

**BENICIA REFINERY PARTICULATE**

**RELEASE**

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**Benicia, CA**

**March 29, 2019**

**Project #111391**

## 1.0 Introduction

On March 23, 2019 Valero Energy requested that CTEH® conduct air monitoring in the surrounding community after a release of particulate matter from the Benicia Refinery in Benicia California. CTEH® arrived on-site on March 24, 2019 and began air monitoring operations. Activities were comprised of real-time air monitoring and analytical air sampling.

This report summarizes air monitoring data collected from March 28, 2019 06:00 PDT to March 29, 2019 06:00 PDT.

## 2.0 Air Monitoring and Sampling Methods

CTEH® developed and implemented an air sampling and analysis work plan (SAP) to document and quantify the release of fugitive emissions from the flue gas scrubber. All instrumentation was calibrated at least once per day or per manufacturer's recommendations. Target analytes were measured as, carbon monoxide (CO), nitrogen dioxide (NO<sub>2</sub>), 2.5-micron particulate matter (PM<sub>2.5</sub>), and 10-micron particulate matter (PM<sub>10</sub>), sulfur dioxide (SO<sub>2</sub>), and volatile organic compounds (VOCs) using handheld instruments such as RAE Systems MultiRAEs, TSI SidePak™ AM510/AM520 Aerosol Monitors, TSI DustTrak™ Aerosol Monitors, and Gastec GV-100 pumps with chemical-specific colorimetric detection tubes.

Hand-held air monitoring consisted of roaming air monitoring in the surrounding community. All hand-held air monitoring was conducted in the breathing zone.

## 3.0 Air Monitoring Results

Figures 1 – 8 in Attachment A depicts the site location and hand-held monitoring locations for this reporting period.

Table 1 summarizes the results for community hand-held air monitoring readings.

**Table 1: Community Hand-Held Real-Time Air Monitoring Results**

Analyte	Instrument	# Readings	# Detections	Range
CO	MultiRAE	117	0	< 1 ppm
NO <sub>2</sub>	MultiRAE	124	0	< 0.1 ppm
PM <sub>10</sub>	AM510/AM520/DustTrak	35	35	0.003 - 0.013 mg/m <sup>3</sup>
PM <sub>2.5</sub>	AM510/AM520/DustTrak	35	35	0.002 - 0.009 mg/m <sup>3</sup>
SO <sub>2</sub>	MultiRAE	97	0	<0.1 ppm
VOCs	MultiRAE	125	0	< 0.1 ppm

<sup>1</sup>Maximum detections preceded by the "<" symbol are considered non-detections below the limit of detection (LoD) value to the right.

Additionally, at the request of public health officials, particulate matter (PM2.5 and PM10) data have been grouped by downwind direction and averaged over a 24-hour period for comparison to AQI category equivalents. Wind-rose maps are provided for the corresponding time periods (**Appendix B**). It is notable that the USEPA has eliminated spatial averaging provisions as part of the annual National Ambient Air Quality Standards (NAAQS) to avoid potential disproportionate impacts on at-risk populations. Additionally, due to the uneven temporal distribution of particulate matter monitoring data at these locations, averages may be biased and are not directly comparable to the NAAQS. Comparisons to AQI category equivalents are provided for illustration purposes only.

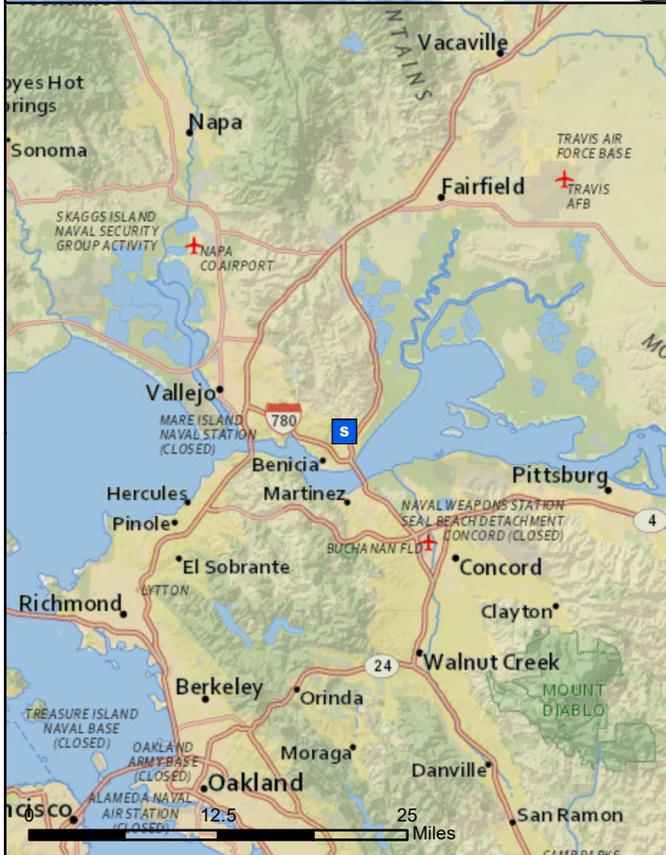
#### **4.0 Weather Conditions**

Figure 12 in attachment C contains meteorological data and a wind rose depicting wind speed and direction for this reporting period. Data was acquired from California Irrigation Management System (CIMIS) meteorological station #170 located in Concord to the southeast of the Benicia Refinery.

# Attachment A

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## CTEH Air Sampling and Monitoring Locations





Legend

- Hand-Held Monitoring Location
- ▭ Benicia Refinery

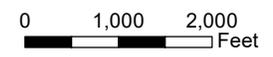


**Legend**

- Benicia Refinery
- PM<sub>10</sub> Concentration (mg/m<sup>3</sup>)**
- 0.001 - 0.138
- 0.139 - 0.351
- >0.352



Figure 4: Hand-Held Real-Time Monitoring Locations (PM<sub>2.5</sub>)  
Benicia Refinery Particulate Release



Project: 111391  
Client: Valero Energy  
City: Benicia, AR  
County: Solano

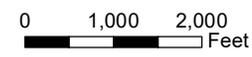


**Legend**

- Benicia Refinery
- PM<sub>2.5</sub> Concentration (mg/m<sup>3</sup>)**
- 0.001 - 0.138
- 0.139 - 0.351
- >0.351



Figure 5: Hand-Held Real-Time Monitoring Locations (CO)  
Benicia Refinery Particulate Release



Project: 111391  
Client: Valero Energy  
City: Benicia, AR  
County: Solano



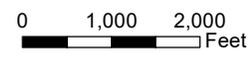
**Legend**

**CO Monitoring Locations**

- No-Detection (<1 ppm)
- Benicia Refinery



Figure 6: Hand-Held Real-Time Monitoring Locations (NO<sub>2</sub>)  
Benicia Refinery Particulate Release



Project: 111391  
Client: Valero Energy  
City: Benicia, AR  
County: Solano



Legend

**(NO<sub>2</sub>) Monitoring Location**

- No-Detection (<0.1 ppm)



Legend

**SO<sub>2</sub> Monitoring Location**

- No-Detection (<0.1 ppm)



Legend

**VOCs Monitoring Location**

- No-Detection (<1.0 ppm)

# Attachment B

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## Directional Averages

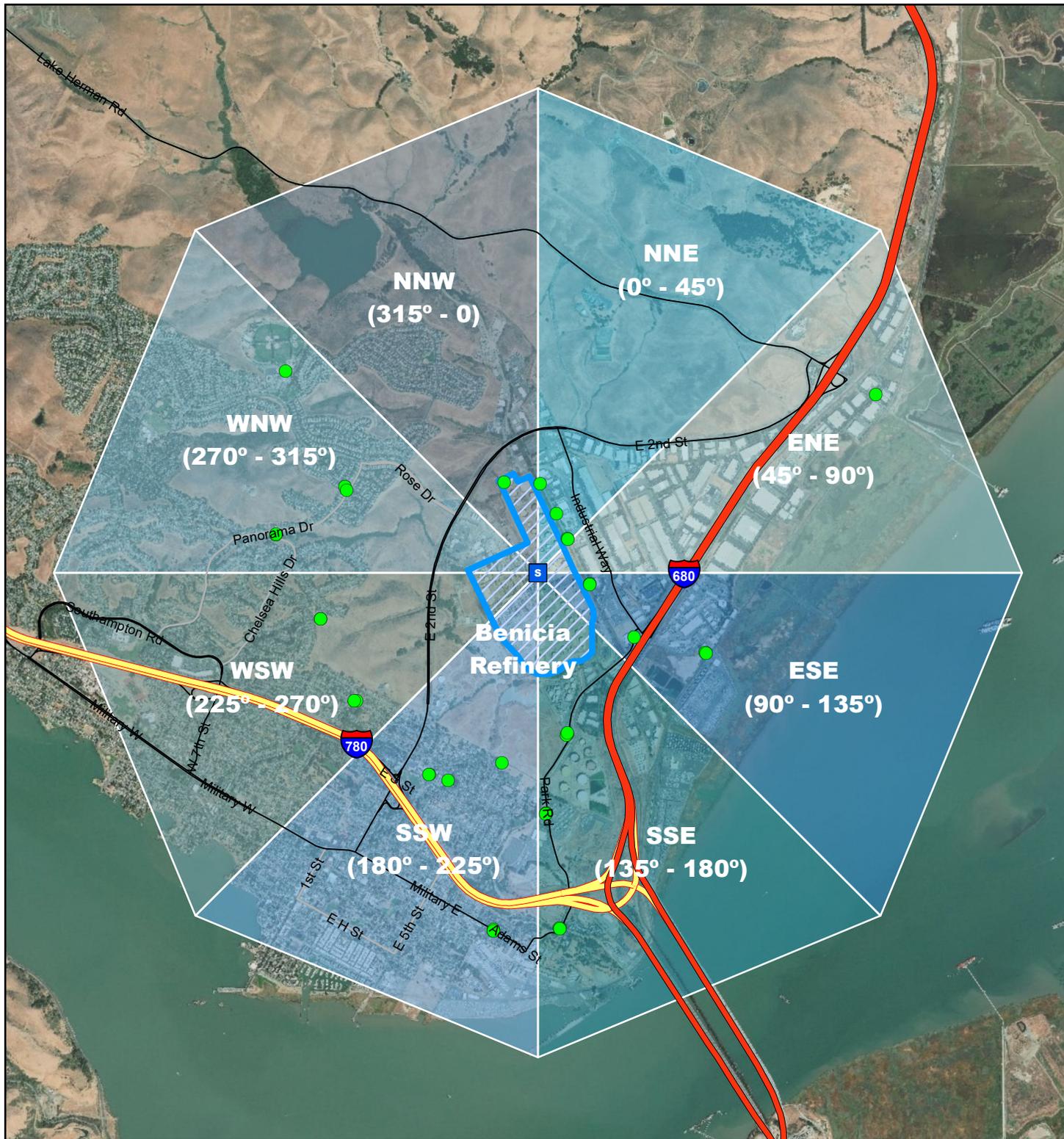


# PM<sub>2.5</sub> Directional Averages Benicia Refinery Particulate Release

**PM<sub>2.5</sub> Avg. for 24 Hour Period**  
**March 28 06:00 - March 29 06:00<sup>1</sup>**

Direction	# Readings	# Detections	Avg (mg/m <sup>3</sup> )	Range (mg/m <sup>3</sup> )	AQI Category Equivalent
ENE	1	1	0.004	0.004	Good
ESE	5	5	0.0056	0.003 - 0.009	Good
NNE	4	4	0.00575	0.004 - 0.007	Good
NNW	1	1	0.005	0.005	Good
SSE	8	8	0.00488	0.003 - 0.007	Good
SSW	7	7	0.00386	0.002 - 0.006	Good
WNW	5	5	0.0042	0.002 - 0.007	Good
WSW	4	4	0.0045	0.002 - 0.007	Good

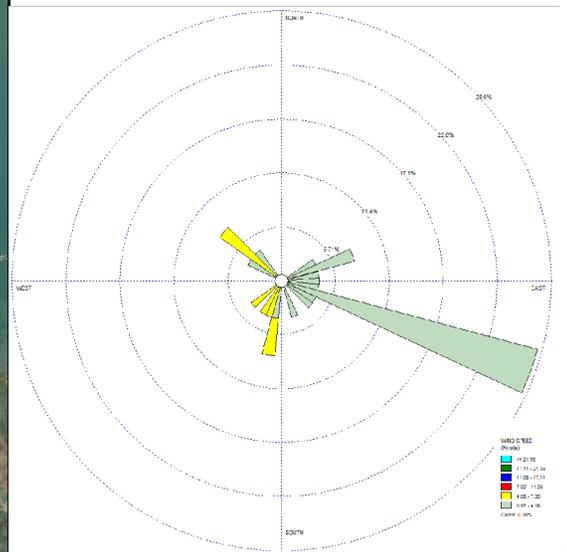
<sup>1</sup>The EPA has eliminated spatial averaging provisions as part of the annual National Ambient Air Quality Standards (NAAQS) to avoid potential disproportionate impacts on at-risk populations. Additionally, due to the uneven temporal distribution of particulate matter monitoring data at these locations, averages may be biased and are not directly comparable to the NAAQS.



Benicia Refinery

### Monitoring Direction

- ENE
- ESE
- NNE
- NNW
- SSE
- SSW
- WNW
- WSW



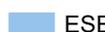
**PM<sub>10</sub> Avg. for 24 Hour Period**  
**March 28 06:00 - March 29 06:00<sup>1</sup>**

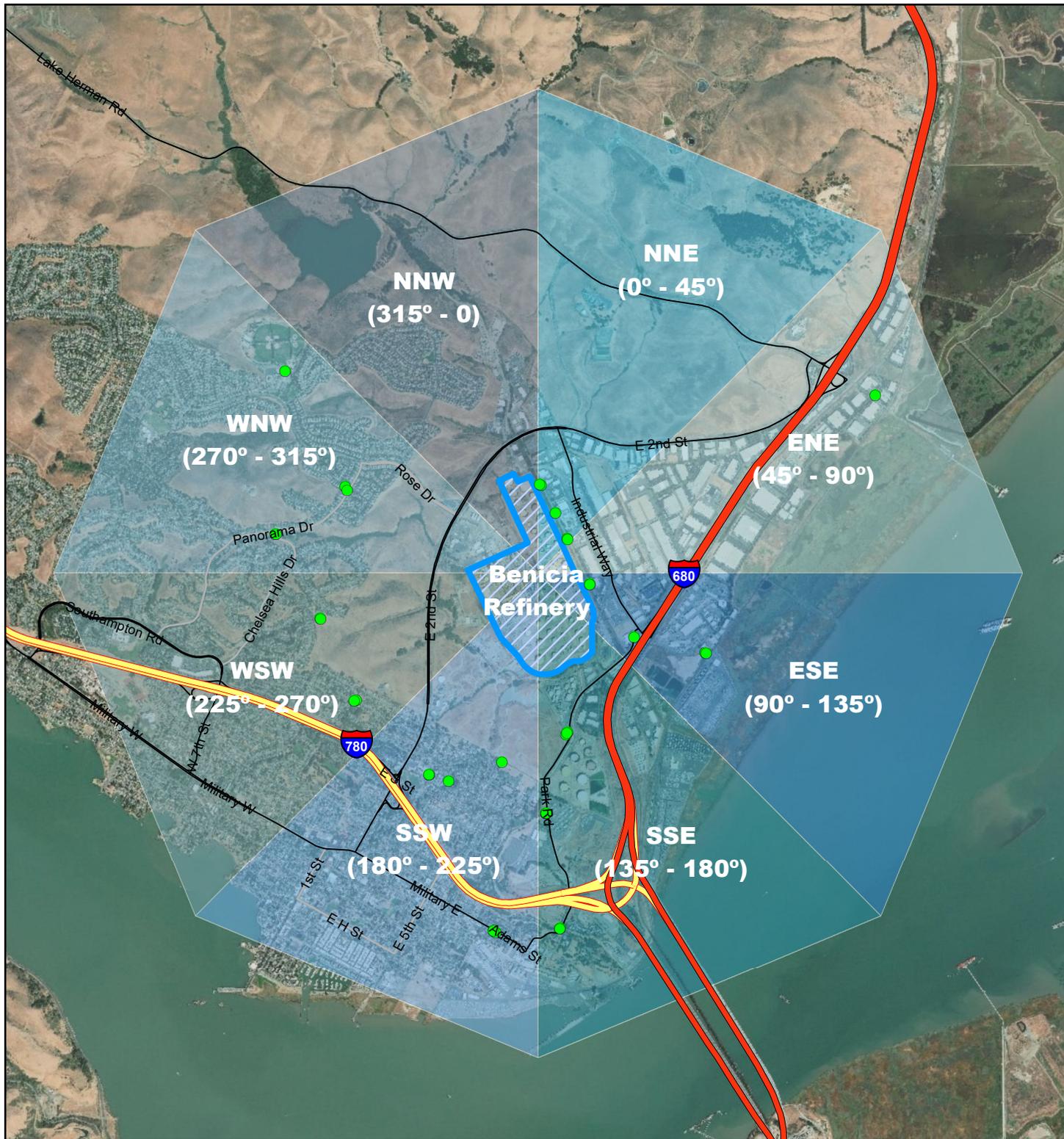
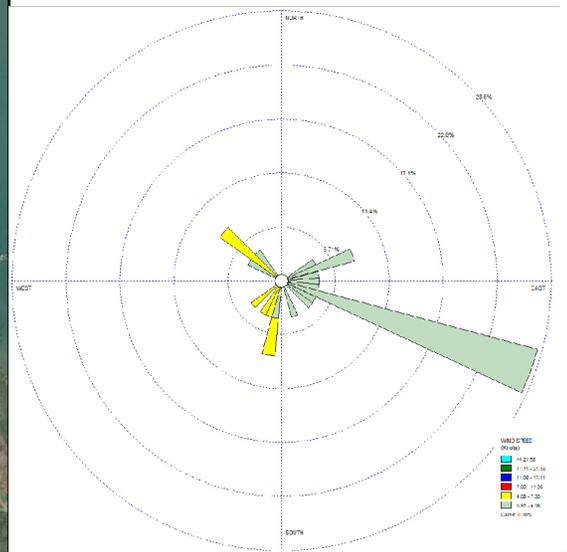
Direction	# Readings	# Detections	Avg (mg/m <sup>3</sup> )	Range (mg/m <sup>3</sup> )	AQI Category Equivalent
ENE	1	1	0.013	0.013	Good
ESE	5	5	0.0072	0.003 - 0.01	Good
NNE	5	5	0.0078	0.005 - 0.009	Good
SSE	8	8	0.00675	0.004 - 0.01	Good
SSW	7	7	0.00614	0.003 - 0.009	Good
WNW	5	5	0.0056	0.004 - 0.008	Good
WSW	4	4	0.00525	0.003 - 0.008	Good

<sup>1</sup>The EPA has eliminated spatial averaging provisions as part of the annual National Ambient Air Quality Standards (NAAQS) to avoid potential disproportionate impacts on at-risk populations. Additionally, due to the uneven temporal distribution of particulate matter monitoring data at these locations, averages may be biased and are not directly comparable to the NAAQS.

 Benicia Refinery

**Monitoring Direction**

-  ENE
-  NNW
-  WNW
-  ESE
-  SSE
-  WSW
-  NNE
-  SSW



# Attachment C

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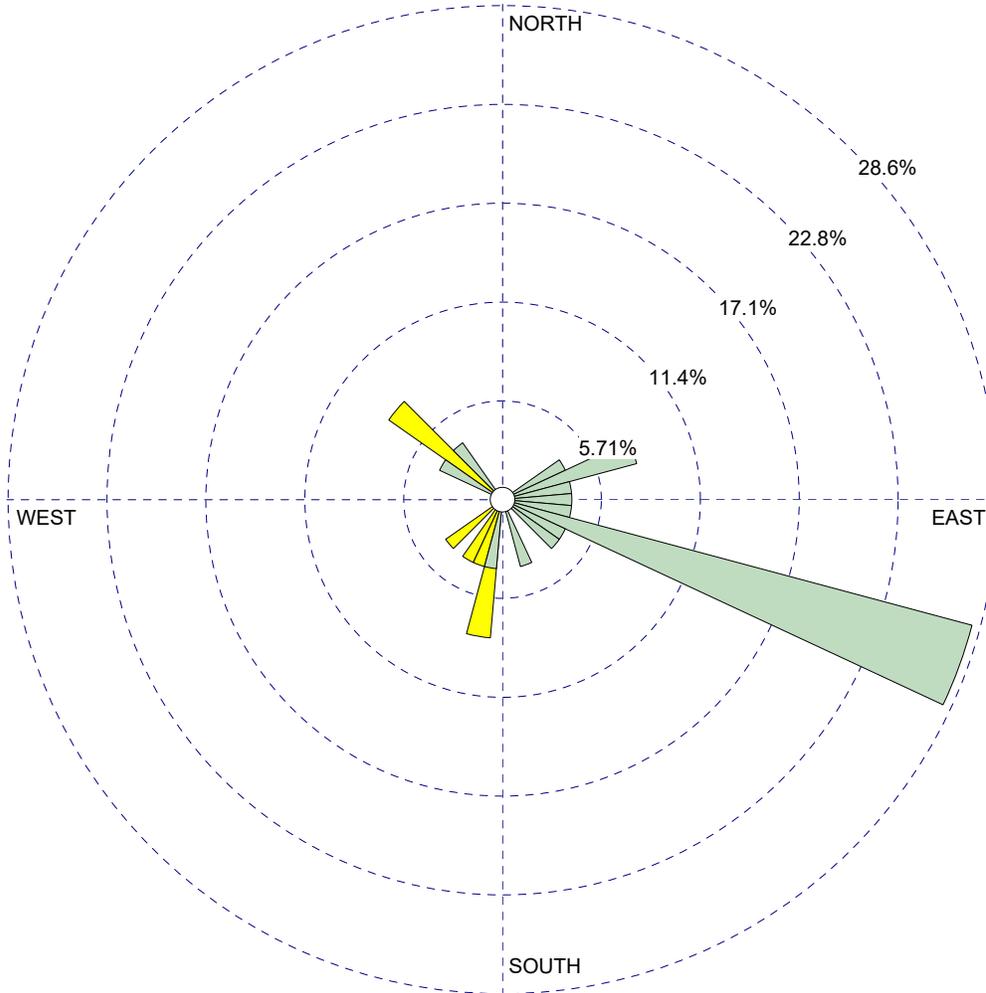
## Meteorological Conditions

WIND ROSE PLOT:

Station #CIMIS

DISPLAY:

Wind Speed  
Direction (blowing from)



WIND SPEED  
(Knots)

- >= 21.58
- 17.11 - 21.58
- 11.08 - 17.11
- 7.00 - 11.08
- 4.08 - 7.00
- 0.97 - 4.08
- Calms: 0.00%

COMMENTS:

DATA PERIOD:

**Start Date: 3/28/2019 - 06:00**  
**End Date: 3/29/2019 - 06:00**

COMPANY NAME:

MODELER:

CALM WINDS:

**0.00%**

TOTAL COUNT:

**25 hrs.**

AVG. WIND SPEED:

**2.52 Knots**

DATE:

**3/29/2019**

PROJECT NO.:

**111391**